UNIVERSITY OF
ILLINOIS LIBRARY
AT URBANA-CHAMPAIGN
[redacted]
BOOKSTACKS
DOCUMENTS

Doc.
I 1.94/2:
12-9

Docs. Bookstacks

TITLE NUMBER | SHIPMENT NO. 44

NEW TITLE
Selected water resources abstracts

HERTZBERG – NEW METHOD, INC. EAST VANDALIA ROAD, JACKSONVILLE, ILL. 62650

TITLE NO.	ACCOUNT NO.	LOT AND TICKET NO.
S-0471.3600B	07200-044	41-00074

43-12 SELECTED * WATER * RESOURCES * ABSTRACTS *

43-24 12 * MAY-JUNE * 1979 *

42-26 DOC.*I1.94/2:*

12/9-12* DOC 2 REB THESE ISS ONLY OTHERS AN

CLOTH COLOR
0055

HEIGHT
10 5/8

CHARGING INFORMATION				HEIGHT	PICA	WRAP
STUBBING		FRONT COVER				
HAND SEW		NO TRIM				
THRU SEW		PAGES LAMINATED				
THRU SEW ON TAPE		EXTRA THICKNESS				
HAND ADHESIVE	✓	MAP POCKET PAPER				
LENGTHWISE		MAP POCKET CLOTH		SPECIAL WORK AND PREP.		
FOREIGN TITLE		SPECIAL WORK				
LINES OF LETTERING						

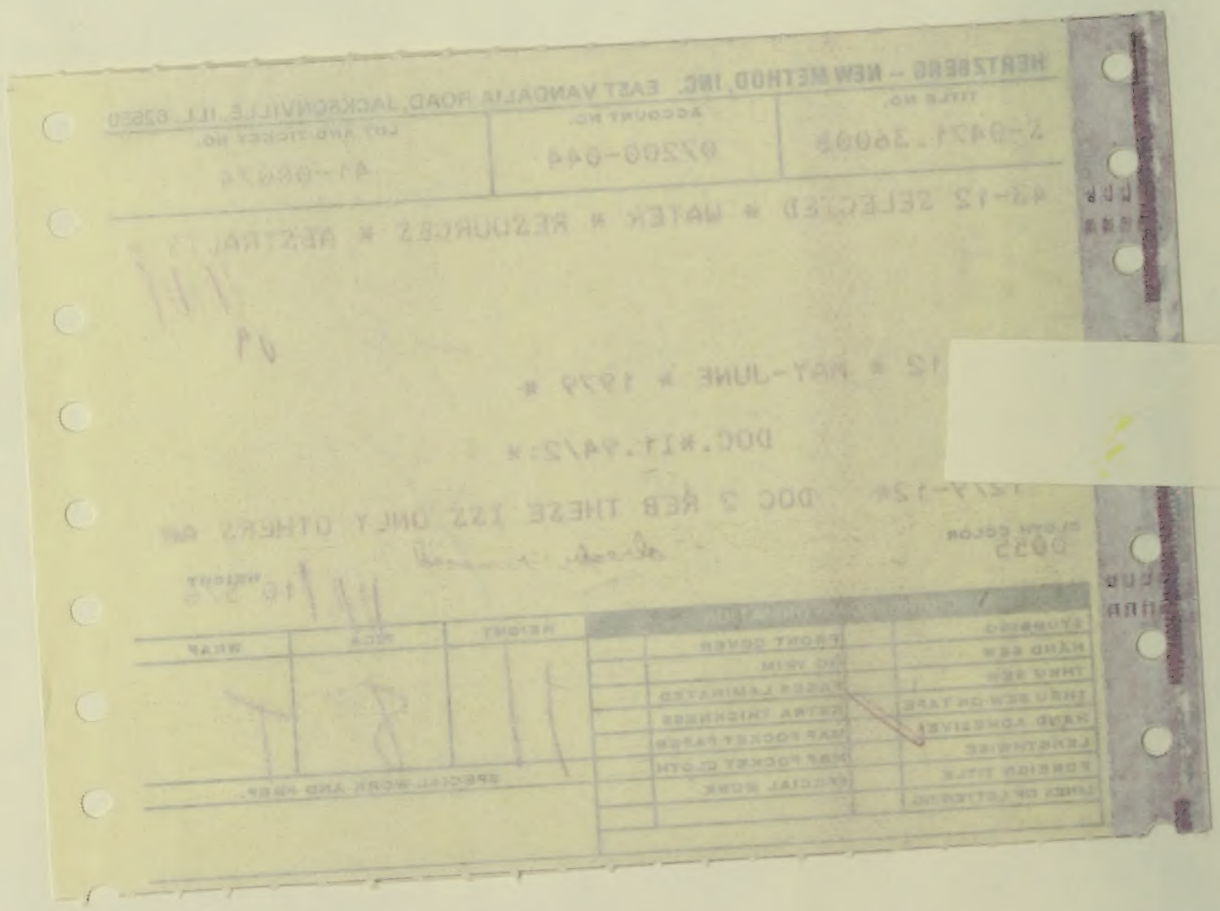
DP-4

2. INSERT IN THE VOLUME

THE LIBRARY OF THE
JUL 29 1981
UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

VOLUME 12, NUMBER 9
MAY 1, 1979

W79-04001--W79-04500
CODEN:SWRABW



Doc.
I 1.94/2:
12-9

Docs. Bookstacks

12w

TITLE NUMBER | SHIPMENT NO. 44

NEW TITLE
Selected water resources abstracts
(For S-471.36, add bdg. color to print-out listing as per this ticket. REBIND these iss. only; others already removed.)

THIRD PANEL

FOURTH PANEL
12
May-June
1979

CALL NUMBER
DOC.
I 1.94/2:
12/9-12

CHANGE CALL NO.
ADD'N. TO CALL NO. x
NO TRIM
MAP POCKET
LOC 2

COLOR NUMBER 55

2. INSERT IN THE VOLUME

SELECTED WATER RESOURCES ABSTRACTS

THE LIBRARY OF THE
JUL 29 1981
UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

VOLUME 12, NUMBER 9
MAY 1, 1979

W79-04001--W79-04500
CODEN:SWRABW

Selected water resources abstracts
(For S-NTIS, add bdg. color
to print-out listing as per this
ticket. REBIND these las. only;
others already removed.)

12
May-June
1979

DOC.
I 1.94/2:
12/9-12

X

55

1. INSERT IN THE VOLUME

Doc.
I 1.94/2:
12-9

Docs. Bookstacks

SELECTED WATER RESOURCES ABSTRACTS

THE LIBRARY OF THE
JUL 29 1981
UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

VOLUME 12, NUMBER 9
MAY 1, 1979

W79-04001--W79-04500
CODEN:SWRABW

SELECTED WATER RESOURCES ABSTRACTS is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce, for the Water Resources Scientific Information Center (WRSIC).

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Manager, Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior, Washington, DC 20240.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is attached to the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are: SWRA Journal only, $75; Journal and Annual Indexes, $100; Indexes only, $50. Other addressees, write for prices.

SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 9
MAY 1, 1979

W79-04001--W79-04500

etary of the U.S. Department of the Interior has de-
that the publication of the periodical is necessary in the
n of the public business required by law of this Depart-
ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

NATURE OF WATER

Properties

IAVIOR OF A MICRO FLOWTHROUGH 'PER ION-SELECTIVE ELECTRODE TEM IN THE MILLIMOLAR TO SUBMI-)MOLAR CONCENTRATION RANGE,
consin Univ.-Madison. Dept. of Chemistry.
. Bladel, and D. E. Dinwiddle.
ytical Chemistry, Vol. 47, No. 7, p 1070-1073, 1975. 7 fig, 1 tab, 10 ref. OWRT A-053-(3).

eriptors: *Electrodes, *Ions, *Water chemistry, pper, *Flow system, Electrochemistry, Meas- g, Electrolytes, Water analysis, Trace ele- s, Water properties, Sampling.

construction and behavior of a gravity-fed o flowthrough electrode system fabricated commercially manufactured silver sulfide- ic sulfide pellets are described. Details of the cation of the micro copper ion-selective elec- es, the flowthrough cell, the solution flow em, and the procedure for the measurement of ntials are presented. The system response time teady-state potentials in the supermicromolar on was similar to responses previously report- or flowing systems. The stability and reproduc- y of the system in the supermicromolar region e good. It is concluded that a steady-state ntial is approached on immersing the electrode solution of copper ion that appears to be nstian within 1 mV down to copper ion con- rations of 10 to the minus 8M for highly differ- modes of pretreatment. The deviation from nstian potential of the nominal 10 to the minus solution correspond to a blank copper concen- on of about 1 x 10 to the minus 9M. (Davison-)
9-04102

PLICATION OF ION EXCHANGE MEM- ANES TO SAMPLING AND ENRICHMENT: 'ERFERENCE OF METAL ION BINDING OUPS,
consin Univ.-Madison. Dept. of Chemistry.
J. Blaedel, and R. A. Niemann.
alytical Chemistry, Vol. 47, No. 8, p 1455-1457, 1975. 1 fig, 20 ref. OWRT A-053-WIS(4).

scriptors: *Ion exchange, *Membranes, *Evalu- n, *Cation exchange, Pollutants, Copper, Dis- ution patterns, Laboratory tests, Absorption, lioactive tracers, Spectrophotometry.

study was undertaken to demonstrate that ion hange membranes contain impurity groups ca- le of binding the metal ion very strongly by chanisms other than the ion exchange mecha- n. The three types of sulfonated cation ex- nge membranes studied were: (1) AMF C-103; Nafion XR-170; and (3) Permion P1010. A ighted piece of each membrane placed in a oratory prepared solution containing known ncentrations of copper and radiotracer, 64 pper, and mechanically stirred for eight hours. fraction, 5 to 10%, of the copper was taken up the membrane, and the copper content and tribution ratio of the membrane were deter- ned from the counting rate of the solution before d after the membranes were extracted from the ution. The Nafion and Permion membranes re subjected to the radiotracer technique for asurement. Since the AMF membrane contained igher level of impurity groups, atomic absorp- n was used in measurement. Transmission in- red spectra were taken on pieces of membrane the sodium form. Spectra acquired with the drogen forms of ion exchange membranes were t interpretable. It is concluded that ion exhange mbranes of the sulfonic acid type contain impu- y groups, some of which bind copper ions ongly. These impurity groups interfere with rmal ion exchange behavior at low concentra- n levels of copper ion, which may preclude use the membrane in some procedures for trace alysis. (Davison-IPA)
W79-04103

A STUDY OF LOUISIANA'S MAJOR ESTUARIES AND ADJACENT OFFSHORE WATERS,
Louisiana Wildlife and Fisheries Commission, New Orleans.
For primary bibliographic entry see Field 2L.
W79-04156

TRANSIENT PRESSURE ANALYSIS IN GEOTHERMAL STEAM RESERVOIRS WITH AN IMMOBILE VAPORIZING LIQUID PHASE--SUMMARY REPORT,
Geological Survey, Menlo Park, CA. Water Resources Div.; and Union Oil Company, Santa Rosa, Calif.
A. F. Moench, and P. G. Atkinson.
In: Proceedings of the Third Stanford Workshop on Geothermal Reservoir Engineering, Stanford University, California, December 14-16, 1977. 6 p, 3 fig, 1 ref.

Descriptors: *Geothermal studies, *Thermal water, *Steam, *Vapor pressure, *Model studies, Heat transfer, Condensation, Wells, Aquifers, Permeability, Porosity, Water yield, Drawdown, *Finite-difference models, Phase change, Radial flow.

A finite-difference model for the horizontal, radial flow of steam in the presence of an immobile vaporizing or condensing liquid phase was adapted from the model of Moench (1976). Results were generated for real physical oarameters, and are presented in terms of standard dimensionless pressure (actually pressure-squared) and time groupings. The analysis assumes an initial constant temperature and pressure in the aquifer and an initial uniform liquid-water distribution which partially fills the void space. It is also assumed that the steam and liquid water in the reservoir are in local thermal equilibrium with the reservoir rocks and that temperature changes occur only in response to phase changes. (Woodard-USGS)
W79-04410

GEOCHEMISTRY OF GEOPRESSURED GEOTHERMAL WATERS FROM THE TEXAS GULF COAST,
Geological Survey, Menlo Park, CA. Water Resources Div., and Geological Survey, Reston, VA. Water Resources Div.
Y. K. Kharaka, E. Callender, and W. W. Carothers.
In: Proceedings of the Third Geopressured-Geothermal Energy Conference, Vol. 1, University of Southwestern Louisiana, Lafayette, Louisiana, November 16-18, 1977, p GI-121-GI-165, 1978. 10 fig, 1 tab, 35 ref.

Descriptors: *Geochemistry, *Geothermal studies, *Chemical analysis, *Water analysis, *Texas, Oil fields, Thermal water, Energy, Membranes, Vapor pressure, Temperature, Salinity, Dissolved solids, Data collections, Evaluation, *Gulf Coast, *Brazoria County, *Galveston County, *San Patricio County.

Waters with abnormally high pressures and temperatures are present at depths greater than about 3,000 meters in Cenozoic and Mesozoic sedimentary rocks beneath an area of about 350,000 sq km in coastal Texas and Louisiana. There is an intensive effort to determine the feasibility of using these geopressured geothermal waters as a source of energy. Three forms of energy may be extracted from these waters: (1) Thermal energy, (2) mechanical (hydraulic) energy, because these waters will be under high pressure at ground level, and (3) energy obtained from dissolved gases, mainly methane, which may equal the thermal energy (Papadopulos et al, 1975) provided the waters are saturated with natural gas under subsurface conditions. This paper reports detailed chemical analyses of 48 formation and 4 shallow ground-water samples obtained from 10 oil and gas fields in the Houston-Galveston and Corpus Christi areas of Texas. Deuterium and 0-18 analyses for 25 of these samples also are included. Procedures and equations, based on the chemical geothermometers and vapor-pressure data for water at the subsurface conditions are given to identify samples diluted by condensed water vapor produced with natural gas and to estimate their true salinities. The formation waters were obtained from geopressured and normally pressured production zones ranging in depth from about 1,000 to about 4,300 m. (Woodard-USGS)
W79-04414

1B. Aqueous Solutions and Suspensions

WATER: A COMPREHENSIVE TREATISE. (VOL. 5). WATER IN DISPERSE SYSTEMS.
Plenum Press, New York and London, C1975. Franks, F. (editor). 366 p, 732 ref.

Descriptors: *Water properties, *Dispersion, Chemical reactions, Water, Hydration, Capillary action, Foaming, Emulsions, Colloids, Thin films, Clays, Thermodynamic behavior, Water structure, Dynamics, Adsorption, Water types, Biopolymers, Clay-water systems, Textbooks.

The 6 chapters by different experts deal with the influence of hydration on the stability of colloidal hydrophonic systems; the properties of water in capillaries and thin films; hydration and the stability of foams and emulsions; clay-water systems; adsorption of water on well-characterized solid surfaces; and specific interactions of water with biopolymers (thermodynamic, structural, and dynamic properties of sorbed water). A bibliography and subject, author, and compound indexes are appended. (Brown-IPC)
W79-04257

SUSPENDED SOLIDS IN WATER.
For primary bibliographic entry see Field 2L.
W79-04258

2. WATER CYCLE

2A. General

QUALITY AND MOVEMENT OF GROUND WATER IN OTTER CREEK - DRY CREEK BASIN, CORTLAND COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
W. Buller, W. J. Nichols, and J. F. Harsh.
Geological Survey Water-Resources Investigations 78-3 (open-file report), 1978. 63 p, 24 fig, 10 tab, 27 ref.

Descriptors: *Groundwater movement, *Water quality, *Aquifers, *Observations wells, *Water pollution sources, Chlorides, Nitrates, Groundwater recharge, Water levels, Surface-groundwater relationships, Model studies, Digital computers, New York, *Cortland County, Otter Creek-Dry Creek basin.

A steady increase in the chloride and nitrate content of water in a sand and gravel aquifer of glacial origin in the Cortland, N.Y., area prompted a study to obtain data on the extent and source of these constituents. Chloride concentration in the upper part of the aquifer increased generally from 2 mg/liter in 1930 to 20 mg/liter in 1976, and nitrate concentration (as nitrogen) in the upper part of the aquifer increased from 1 mg/liter in 1930 to an average of 4 mg/liter in 1976. Although the ground water is normally very hard, its quality generally meets State standards for source waters used for drinking. Road salting and farming seem to be the primary cause of chloride increases, although septic systems may be a major source locally. Farm-animal waste, sewage systems, and fertilizers are the major contributors of nitrate to ground water. Flow in the aquifer system in the Otter Creek-Dry Creek basin was simulated with a digital-computer model. The model was calibrated by comparing measured water levels in the aquifer

with those determined by the model. The major sources of recharge are from precipitation and seepage from losing reaches of the streams. (Woodard-USGS)
W79-04035

CLIMATE, SOIL, AND VEGETATION--1. INTRODUCTION TO WATER BALANCE DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol 14, No 5, p 705-712, October 1978. 8 fig, 16 ref.

Descriptors: *Water balance, *Model studies, *Statistics, Mathematical models, Computer models, Rainfall, Precipitation(Atmospheric), Infiltration, Percolation, Groundwater, Water table, Soils, Soil properties, Vegetation, Evapotranspiration, Evaporation, Soil water, Soil moisture, Runoff, Fluid mechanics, Water balance dynamics.

A statistical dynamic formulation of the vertical water budget at a land-atmosphere interface was outlined. Physically based dynamic and conservation equations expressed the infiltration, exfiltration, transpiration, percolation to groundwater, and capillary rise from the water table during rainstorms and interstorm periods in terms of independent variables representing the precipitation, potential evapotranspiration, soil and vegetal properties, and water table elevation. Uncertainty was introduced into these equations through the probability density functions of the independent climatic variables and yields derived probability distributions of the dependent water balance elements: surface runoff, evpotranspiration, and groundwater runoff. The mean values of these quantities give a long-term average water balance which, to the first order, defines the annual water yield and water loss in terms of the annual precipitation and potential evapotranspiration and in terms of physical parameters of the soil, vegetation, climate, and water table. This analytical framework provides physical insight into the dynamic coupling of climate-soil-vegetation systems. Details were presented in a series of subsequent papers. (See W79-04038 thru W79-04043) (Sims-ISWS)
W79-04037

CLIMATE, SOIL, AND VEGETATION--6. DYNAMICS OF THE ANNUAL WATER BALANCE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 749-764, October 1978. 11 fig, 4 tab, 20 ref. NSF ENG76-11236.

Descriptors: *Water balance, *Model studies, *Mathematical models, Statistics, Soil properties, Soils, Soil moisture, Evapotranspiration, Runoff, Surface runoff, Subsurface runoff, Vegetation, Biomass, Precipitation(Atmospheric), Rainfall, Probability, Equations, Infiltration, Soil water, Groundwater, Water balance dynamics.

Mass conservation was employed to express the natural water balance of climate-soil-vegetation systems in terms of the average annual values of precipitation, evapotranspiration, surface runoff, and groundwater runoff as derived from the probability distributions of storm properties and from the physics of the appropriate storm and interstorm soil moisture fluxes. The resulting conservation equation was used to define the dimensionless parameters governing the dynamic similarity of the annual water balance. An asymptotic analysis of this water balance equation yielded a set of rational criteria for the classification of climate-soil-vegetation systems. Sensitivity with respect to the primary climate, soil, and vegetal parameters demonstrates that qualitative changes in water balance behavior are primarily dependent upon the exfiltration effectiveness of the soil. A natural selection hypothesis was presented which specifies the stable vegetation density and the plant coefficient for a given climate-soil system in which water and not nutrition or light is limiting. (See also W79-04037) (Sims-ISWS)
W79-04042

CLIMATE, SOIL, AND VEGETATION--7. A DERIVED DISTRIBUTION OF ANNUAL WATER YIELD,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 765-776, October 1978. 10 fig, 3 tab, 13 ref. NSF ENG76-11236.

Descriptors: *Water balance, *Soil water, *Water yield, *Model studies, Water resources, Precipitation(Atmospheric), Rainfall, Soil moisture, Soil water, Soil water movement, Vegetation, Evapotranspiration, Runoff, Infiltration, Soil properties, Equations, Frequency, Statistics, Probability, Climates, Soil science, Meteorology, Climatology.

The average annual soil moisture balance, as derived from the mechanics of storm and interstorm soil moisture movement and from the statistics of the climatic variables, was used to define the average annual soil moisture. This soil moisture was used in the equation for average annual yield to give a first-order approximation of the annual precipitation yeild function. This function was used to transform the cumulative distribution function (cdf) of annual precipitation into the cdf of annual yield, and application was made in a subhumid and in an arid climate. The derived yield frequency function was seen to be sensitive to the soil and vegetal properties. Proper selection of these parameters brings close agreement with observed streamflow-frequency and suggests the model's utility for parameterizing drainage basins with respect to effective average soil and vegetal properties. (See also W79-04037)(Sims-ISWS)
W79-04043

COMPUTER PROGRAMS IN WATER RESOURCES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 7C.
W79-04081

A UNIFIED APPROACH TO WATERSHED MODELLING,
Benin Univ. (Nigeria).
A. A. Afounda.
Nordic Hydrology, Vol. 9, No. 3/4, p 161-172, 1978. 1 fig, 19 ref.

Descriptors: *Watersheds(Basins), *Rainfall, *Runoff, *Model studies, Mathematical models, Equations, Flow, Overland flow, Groundwater movement, Unsaturated flow, Surface runoff, Rainfall-runoff relationships, Hydrology, Subsurface runoff, Watershed modelling.

This paper summarized the main points of a theoretical study of the general watershed behavior on the basis of the known deterministic physics-based approaches for overland flow, underground flow, and unsaturated medium physics. A parameter z(theta) which describes the soil water movement in the unsaturated zone and accounts for evaporation was introduced. Thus, a differential equation which allows a state-space formulation of the processes in the watershed was obtained, and the solution of the state equation can be given the form of the Volterra Integral series. The obtained results were compared with those of previous studies. (Sims-ISWS)
W79-04084

APPLICATION OF A VERSION OF THE STANFORD MODEL TO A SMALL PIEDMONT WATERSHED,
Clemson Univ., SC. Dept. of Agricultural Engineering.
J. T. Ligon, and A. G. Law.
Transactions of the ASAE American Society of Agricultural Engineers, Vol. 16, No. 2, p 261-265, 1973. 8 fig, 2 tab, 10 ref. OWRT A-010-SC(6).

Descriptors: *Simulation, *Model tests, *Streamflow, Peak runoff, Storm runoff, Surface runoff, Base flow, Flood hydrographs, *Stanford Model.

An evaluation of a version of the Stanford Watershed Model as applied to the Clemson Research Watershed is reported. Best-fit parameters for this watershed are presented. Examples of the agreement between observed and simulated streamflow for annual, monthly, daily, and individual storm periods are presented in tabular and graphical form. Important model parameters related to accurate prediction of streamflow for each period are listed and discussed. Very good predictions of annual streamflow and reasonably good predictions of monthly flow were obtained. Storm hydrographs were simulated less accurately. However, high flow frequencies for simulated and recorded flows were in acceptable agreement. (See also W72-06602)
W79-04086

FINITE ELEMENT SOLUTION OF SAINT-VENANT EQUATIONS,
Nevada Univ., Reno.
For primary bibliographic entry see Field 10D.
W79-04100

A STORAGE-ROUTING MODEL RELATING DRAINAGE BASIN HYDROLOGY AND GEOMORPHOLOGY,
Wollongong Univ. (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-04222

A METHOD FOR PARAMETER SENSITIVITY ANALYSIS IN DIFFERENTIAL EQUATION MODELS,
Albany Medical Coll., NY. Div. of Computer Science.
For primary bibliographic entry see Field 6A.
W79-04229

TOPOLOGICAL CLASSIFICATIONS OF DRAINAGE NETWORKS: AN EVALUATION,
Indiana Univ., Bloomington. Dept. of Geography.
L. J. Onesti, and T. K. Miller.
Water Resources Research, Vol. 14, No. 1, p 144-148, February, 1978. 3 fig, 2 tab, 17 ref.

Descriptors: *Drainage, Channels, Geomorphology, *Networks, Classification, Basins, Correlation analysis.

Channel networks for 103 drainage basins ranging in size from 0.65 to 199 sq km were classified according to 9 topologic systems ranging from Strahler's order and Shreve's magnitude to those recently derived by Werner and Smart. Correlation coefficients and coefficients of determination were calculated to test the relationship between these systems and 10 characteristics of drainage basins and stream channels. The results suggest that (1) network properties are closely associated with basin area and with other characteristics primarily determined by area, (2) the hydraulic variables are essentially unrelated to all topologic systems analyzed, and (3) certain newly proposed topologic systems are unrelated to all characteristics tested, including area. (Skogerboe-Colorado State)
W79-04232

DESERTIFICATION OF THE GREAT PLAINS: WILL IT HAPPEN,
Clark Univ., Worcester, MA.
M. J. Bowden.
Economic Geography, Vol. 53, No. 4, p 397-406, Oct. 1977. 30 ref.

Descriptors: *Agroclimatology, *Arid lands, *Land management, *Desertification, *Droughts, Water management(Applied), Climatology, Water

shortage, Weather modification, Hydrologic budget, Land conservation, Farm management, Land reclamation, Arable land, Soil reclamation, Irrigation practices, Precipitation(Atmospheric), Great Plains, Forecasting.

The prospect of future desertification in the American Great Plains is considered under the headings of three central issues: (1) will climatic change take place, (2) will the region's soil and water resources be lost or depleted by the existing livelihood systems, and (3) will there be enough people willing to continue farming in the region. Consideration of Willett's solar-climatic hypothesis indicates that desertification of the Great Plains through purely physical causes in the next century is slight. Although other theories suggest regular, recurrent drought in the plains or climatic changes due to random frequency changes in the upper air patterns, it is probably safe to conclude that conditions in the plains in the next century are likely to be no worse than the last century in terms of precipitation effectiveness. Adaptation to the plains environment has proceeded rapidly, creating doubt that the levels of stress in the early drought periods will ever again be replicated or approached. Major features of this adaptation have been (1) an increase in farm size, (2) reduction in the number of farmers caused by farm consolidation, (3) major changes in crops and cropping practices, and (4) older, better educated and more persistent farmers. It is concluded that while some soil losses and reductions of irrigated land will occur, conditions will never again approach those of the 1930-1960 period. (Tickes-Arizona)
W79-04285

DESERTIFICATION OF ARID LANDS,
Texas Tech Univ., Lubbock.
H. E. Dregne.
Economic Geography, Vol. 53, No. 4, p 322-331, Oct. 1977. 6 fig, 1 tab, 6 ref.

Descriptors: *Desertification, *Mapping, *Distribution patterns, *Surveys, Areal mapping, Droughts, Environment, Atlas, Terrain analysis, Soil surveys, Climatic data, Evaluation, Hydrological data, Weather data, Classification, Arid lands.

Here desertification is defined as the impoverishment of arid, semiarid, and subhumid ecosystems by the combined impact of man's activities and drought. This authority concedes that very little reliable information is available on the extent of desertification in various countries, so the maps presented here, as a means of identification of the process, are based on a minimum of accurate data relating to vegetative changes, wind and water erosion, and soil salinization. The classification system devised calls for four levels of deterioration as criteria: slight, moderate, severe, and very severe. While only the extent of desertification is illustrated in these maps, and susceptibility has been evaluated subjectively in arriving at estimates of deterioration, the author urges their use within a framework of recognition that they are intended only as general guides in the assessment of the status of desertification in the world's arid regions. (Tickes-Arizona)
W79-04287

EARTH-ATMOSPHERE SYSTEMS AND SURFACE REFLECTIVITIES IN ARID REGIONS FROM LANDSAT MSS DATA,
Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences; and National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
. Otterman, and R. S. Fraser.
Remote Sensing of Environment, Vol. 5, No. 4, p. 47-266, 1976. 10 fig, 5 tab, 26 ref.

Descriptors: *Albedo, *Reflectance, *Remote sensing, Radiation, Satellites(Artificial), Atmosphere, Turbidity, Water vapor meteorology, Atmospheric physics, Arid regions, Meteoric water.

Overgrazing, cultivation and other anthropogenic pressure have been reported as having a strong impact upon the surface albedo (reflectivity) of water stressed arid regions throughout the world. The purpose of this paper is to report the values of vertical reflectivity (albedo) from selected arid regions as measured by the Landsat multispectral scanner (MSS). Results of computed atmospheric transmission and scattering data are presented in terms of the ratio between earth-atmosphere system reflectivity and ground reflectivity for various solar elevation angles and atmospheric models. These ratios are then used to compute ground reflectivities from space nadir reflectivities assuming average atmospheric conditions. The ratios are presented as graphs for two water vapor levels and the effect of variation in atmospheric turbidity and water vapor content on the accuracy of albedo measurements is determined and assessed. The estimated albedo measurements are in the range of 0.34 - 0.52 higher than previously reported but are consistent with laboratory and in situ measurements. (Tickes-Arizona)
W79-04297

FLOODING IN THE DESERT - NATURE'S PARADOX,
D. Sagramoso.
Arizona Professional Engineer, Vol. 30, No. 7, p. 11, July, 1978. 2 fig.

Descriptors: *Flood control, *Flood protection, Dams, Drainage programs, Flood damage, Flood plains, Reservoir operation, Watershed management, Water distribution(Applied), Flood discharge, Peak discharge, Overland flow, Administrative agencies, Arizona.

Although flooding in the desert is a paradox to many there are several reasons for this occurence. The periodic floods in Maricopa County, which lies entirely within the Gila River watershed covering an area of 58,000 square miles or about one half the state of Arizona, is used here to illustrate the problem. Water from the Gila River and its tributaries flows into Maricopa County from three sides and funnels out via the western boundary of the county to the Colorado River at Yuma. Flooding dangers are precipitated by the rapid runoff from the mountains surrounding the greater Phoenix area, the relatively steep decline of the Salt River, the lack of percolation into the frozen ground at higher elevations, and snow melt of the Spring rains. State authorities have recognized these problems and created special flood control districts as municipal corporations and political subdivisions of the state. The operation and financing of the flood control district of Maricopa County is described. This district organization was organized in 1959 and remains today the only special flood control district in Arizona. (Tickes-Arizona)
W79-04300

PREDICTING LONGITUDINAL DISPERSION OF POLLUTANTS IN RIVERS,
Missouri Univ.- Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04365

MODELING DISSOLVED OXYGEN IN THE NEAR-FIELD,
Tulane Univ., New Orleans, LA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04366

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

2B. Precipitation

CLIMATE, SOIL, AND VEGETATION--1. INTRODUCTION TO WATER BALANCE DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04037

CLIMATE, SOIL, AND VEGETATION--2. THE DISTRIBUTION OF ANNUAL PRECIPITATION DERIVED FROM OBSERVED STORM SEQUENCES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol 14, No 5, p 713-721, October 1978. 12 fig, 1 tab, 11 ref.

Descriptors: *Precipitation(Atmospheric), *Storms, *Frequency, *Temporal distribution, Statistics, Model studies, Mathematical models, Duration curves, Precipitation intensity, Rainfall intensity, Probability, Climatic data, Climatology, Meteorology.

Point precipitation was represented by Poisson arrivals of rectangular intensity pulses that have random depth and duration. By assuming the storm depths to be independent and identically gamma distributed, the cumulative distribution function for normalized annual precipitation was derived in terms of two parameters of the storm sequence, the mean number of storms per year, and the order of the gamma distribution. In comparison with long-term observations in a subhumid and an arid climate, it was demonstrated that when working with only 5 years of storm observations, this method tends to improve the estimate of the variance of the distribution of the normalized annual values over that obtained by conventional hydrologic methods which utilize only the observed annual totals. (See also W79-04037) (Sims-ISWS)
W79-04038

CLIMATE, SOIL, AND VEGETATION--6. DYNAMICS OF THE ANNUAL WATER BALANCE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04042

CLIMATE, SOIL, AND VEGETATION--7. A DERIVED DISTRIBUTION OF ANNUAL WATER YIELD,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04043

RESERVOIR SEDIMENTATION AS A FUNCTION OF PRECIPITATION VARIABILITY,
Maryland Univ., Baltimore. Dept. of Geography.
For primary bibliographic entry see Field 4D.
W79-04061

USING SATELLITE IMAGERY TO DETECT AND ESTIMATE RAINFALL FROM FLASH-FLOOD PRODUCING THUNDERSTORMS,
National Environmental Satellite Service, Washington, DC. Applications Div.
R. A. Scofield.
In: Preprint Volume: Conference on Weather Forecasting and Analysis and Aviation Meteorology, Silver Spring, Maryland, October 16-19, 1978. American Meteorological Society, Boston, Massachusetts, 1978. p 132-141, 25 fig, 4 ref.

Descriptors: *Flash floods, *Remote sensing, *Satellites(Artificial), Floods, Rainfall, Thunderstorms, Excessive precipitation, Precipitation(Atmospheric), Radar, Rain gages, Infrared radiation, Isohyets, Data processing, Analytical techniques, Meteorology, *Satellite imagery.

The purpose of this paper was twofold: (1) to present the results of the Scofield/Oliver technique on four major flash flood producing rainstorms, and (2) to determine what signatures in the imagery were common to each of these rainstorms. The

flash flood producing rainstorms occurred in the following locations: Chicago, IL, June 13-14, 1976; Big Thompson Canyon, CO, July 31-August 1, 1976; Johnstown, PA, July 19-20, 1977; and Kansas City, MO, September 12-13, 1977. A procedure was described that uses the principles developed for point rainfall estimates but applied differently to give area rainfall. Satellite-derived area rainfall calculations were used in this study to detect and estimate rainfall from the four flash flood producing thunderstorms. The scheme successfully analyzed the heavy rainfall accumulation associated with each of the flashflood producing thunderstorms. Signatures in the imagery were common to each of the flash flood producing rainstorms. (Sims-ISWS)
W79-04072

A UNIFIED APPROACH TO WATERSHED MODELLING,
Benin Univ. (Nigeria).
For primary bibliographic entry see Field 2A.
W79-04084

SOME ERRORS IN PRECIPITATION MEASUREMENTS,
Aarhus Univ., (Denmark). Inst. of Geology.
K. R. Rasmussen, and C. Halgreen.
Nordic Hydrology, Vol. 9, No. 3/4, p 145-160, 1978. 7 fig, 3 tab, 14 ref.

Descriptors: *Precipitation(Atmospheric), *Measurement, *Rain gages, Equipment, Instrumentation, Winds, Evaporation, Sites, Adhesion, Condensation, Rainfall, Snowfall, Meteorology, *Error analysis, Measurement errors, Aerodynamics effects, Wind screens, Splash.

The effect of gauge height, exposure, and screening on systematic errors in rainfall estimation was investigated. Adhesion losses were found to be more than 2% of the annual precipitation, but for summer periods alone adhesion losses can amount to over 5%. A statistical model using the square root of observations (corrected for adhesion) was found to be adequate to describe difference due to the aerodynamic effects. A correction formula was proposed. (Sims-ISWS)
W79-04088

THE EFFECTS OF RAIN GAGE DENSITIES ON THE ANALYSIS OF STORM TOTAL RAINFALL FROM CONVECTIVE COMPLEXES,
Eddy (Amos), Inc., Norman, OK.
A. Eddy, and L. Hembree.
Final Report, September 1978. 82 p, 34 fig, 12 tab, 6 ref. 7-07-83-V007.

Descriptors: *Meteorology, *Rainfall, *Storm structure, Rainfall intensity, Rain gages, Distribution patterns, Storms, Instrumentation, Mathematical studies, Algorithms, Simulated rainfall, Radar, Remote sensing, Time lag.

The Eddy Statistical Objective Analysis, a system for determining rainstream characteristics and quantities was tested. The small scale capabilities of the analysis algorithm were tested in the analysis of a small storm, termed a 'worst case', and the analysis of a larger storm as a comparison. Total rainfall volume was obtained using radar reflectivities and rain gage data. Simulated rain gage data was used to test the system's sensitivity in detecting storm total rainfall through observations of the rainfall patterns produced by an analytical function termed the SIGNAL GENERATOR. It was found that rainfall gradients dictated the density requirements of the precipitation pattern. Simulated storms were analyzed from two sets of 400 storms each comprised of gage only observations. Between-storm discrimination techniques, and the use of the linear discriminant function to combine storm attributes are discussed. (Davison-IPA)
W79-04108

ESTIMATING PEAK DISCHARGES IN SMALL URBAN HAWAIIAN WATERSHEDS FOR SELECTED RAINFALL FREQUENCIES, KANE'OHE WATERSHED, O'AHU, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
N. C. Lopez, and G. L. Dugan.
Technical Memorandom No 58, August 1978. 24 p, 9 fig, 5 tab, 11 ref.

Descriptors: *Storm runoff, *Peak discharge, Small watersheds, Time of concentration, *Rainfall-runoff relationships, Urbanizaton, *Flooding, Flood forecasting, Hawaii.

The Hawaii Environmental Simulation Laboratory (HESL) has attempted to simulate some of the consequences of alternative land use-economic decisions. The Kane'ohe region on O'ahu Island, Hawaii was selected as a study area. Flooding, which has historically created hazard areas in Kane'ohe, appears to be significantly altered by the rapid urbanization of the region. The problem of predicting flooding patterns in the Kane'ohe region, as well as Hawaii in general, is complicated by the rather small area of the individual watersheds, the abrupt changes in terrain, and the short times of concentration, generaly less than 1 hr. Using existing technology, a planning-oriented tool for predicting peak discharges resulting from various patterns of urbanization has been developed for Hawaiian conditions. The tool utilizes the U.S. Soil Conservation Service Runoff Curves, a unique time of concentration formula, and the U.S. Weather Bureau Rainfall-Frequency Atlas of the Hawaiian Islands. Areas within the watershed were segregated by ranges of slope into response zones. Input data include soil class and cover, hydraulic length, and average slope. The model was applied to ten individual watersheds within the Kane'ohe region, and estimates of peak discharge for the watersheds were made for selected rainfall return intervals. Peak discharge values were determined for existing land use and for three different scenarios (hypothetical patterns of urban growth) for the year 1995. Tests of the model using the rather limited existing peak discharge records have been very encouraging.
W79-04126

PRECIPITATION MANAGEMENT AND THE ENVIRONMENT, AN OVERVIEW OF THE SKYWATER IX CONFERENCE.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 030, Price codes: A10 in paper copy, A01 in microfiche. September 1977. 223 p, 10 fig, 6 Append.

Descriptors: *Environmental effects, *Weather modification, *Precipitation, *Induced precipitation, *Environmental control, *Cloud seeding, *Water resources management, Institutions, Erosion, Wildlife habitats, Sedimentation, Silver iodide, Vegetation effects, Colorado, *Alpine areas, Abiotic processes, Precipitation management.

The Skywater IX Conference was held in Vail, CO. in September 1977, to assess the present status of knowledge on possible environmental effects from widespread or prolonged application of the techniques of precipitation management that Project Skywater is developing, and to provide information for planning. The conference was organized into 6 workshops, each one presenting its own report. In the area of abiotic processes, precipitation management had the greatest effect on erosion and water yield and little effect on water quality and channel processes; alpine settings were considered the most sensitive to precipitation changes; erosion and mass wasting are leading issues for summer programs, and snow duration for winter programs. In the area of vegetation, effects in the High Plains come mostly from possible changes in land use and cultivation stemming from rain stimulation, whereas in alpine areas, snow duration would be the most important factor. Animal species selected as impact receptors by the workshop studying animals included pronghorns, affected by possible encouragement of encroaching civilization, and elk and mule deer, affected by possible influence on range conditions, especially winter range. Anticipated societal benefits of more crops and clean power face barriers because of inadequate information on ownership and the cost of water developed by precipitation augmentation, and the lack of appropriate institutions for carrying it on. Seeding agents like silver iodide were found to have no significant effects. The environmental overview noted concern for possible initiation of long-term trends, linkage with conservation activities, and information transfer in the context of a regional concept. (Coan-NC)
W79-04157

A RAINFALL SIMULATOR FOR FIELD STUDIES OF RUNOFF AND SOIL EROSION,
Waite Agricultural Research Inst., Glen Osmond (Australia). Dept. of Agricultural Biochemistry and Soil Science,
I. T. Grierson, and J. M. Oades.
Journal of Agricultural Engineering Research, Vol. 22, No. 1, p 37-44, March, 1977. 6 fig, 3 tab, 14 ref.

Descriptors: *Simulated rainfall, *Surface runoff, *Runoff, *Rainfall-runoff relationships, *Simulation analysis, Rainfall intensity, Soil erosion, Infiltration.

Runoff and soil erosion, as indicative of the physical condition of soil surface layers, are important parameters, particularly in arid regions that have been studied through rainfall simulation. Described here is a mobile unit capable of simulating rainfall intensity, drop size and drop velocity within a range of natural rainfall over a test plot of one meter square. Similar to the device developed in Israel, this simulator includes nozzles and a segmented rotating disc to control rainfall intensity. Water is pumped from reservoirs to the nozzles and excess water from the rotating disc is confined and drained back to the reservoirs by a splash guard and roof canopy. Both the spray and circulating water assemblies are built into a unit mounted in a trailer for easy transportation. Detailed characteristics and field use of the simulator are described and graphically illustrated. (Tickes-Arizona)
W79-04289

THE DISASTROUS FLOOD OF '78,
J. A. Wise, Jr.
Arizona Professional Engineer, Vol. 30, No. 7, p 12-13, July 1978, 3 fig.

Descriptors: *Flood control, *Storm runoff, *Flood routing, *Channel improvement, Flash floods, Flood plains, Flow control, River basin development, Watershed management, Flood damage, Historic floods, Regional flood, Structural design, Structural analysis, Peak discharge, High flow, Salt River Basin, Arizona.

Storm events of early 1978, and the consequent flooding of the Salt River in the vicinity of Phoenix, Arizona, are described and illustrated. The storms analyzed here began February 27, 1978, deposited as much as 12.3 inches of rainfall over the next three days on the Verde and Tonto watersheds, and caused considerable damage to the major drainage areas of the Cave Creek and Verde-Salt River Basins. Because the lakes filled rapidly, the Salt River project was required to initiate and manage large releases of flood water into the Verde and Salt River systems. These releases, which reached peak of 115,000 cfs. at the Tempe Bridge, were reasonably well contained in the Salt River Bed but still caused extensive damage at most river crossings and at Sky Harbor Airport. Damage estimates and future structural plans to reduce the possibility of a repeat occurrence are described. (Tickes-Arizona)
W79-04299

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

2C. Snow, Ice, and Frost

THE EFFECT OF ICE COVER ON VERTICAL TRANFER IN STREAM CHANNELS,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W79-04062

2D. Evaporation and Transpiration

CLIMATE, SOIL, AND VEGETATION--4. THE EXPECTED VALUE OF ANNUAL EVAPOTRANSPIRATION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 731-739, October 1978. 6 fig, 24 ref.

Descriptors: *Evapotranspiration, *Evaporation, *Model studies, Mathematical models, Soil moisture, Vegetation, Soils, Soil water, Soil water movement, Precipitation(Atmospheric), Transpiration, Drying, Annual, Equations, Soil science, Bare soils, Interstorm evapotranspiration.

The depth of interstorm evapotranspiration from natural surfaces was composed (by proportion of vegetal canopy density) of evaporation from bare soil and transpiration from vegetation. The former was obtained in terms of random variables describing initial soil moisture, time between storms, and potential rate of evapotranspiration from an exfiltration analogy to the Philip infiltration equation modified to incorporate moisture extraction by plant roots. The latter was assumed to occur at the potential rate for natural vegetal systems. In a zeroth-order approximation, the initial soil moisture was fixed at its climatic space and time average whereby using an exponential distribution of time between storms and a constant potential rate of evapotranspiration the expected value of interstorm evapotranspiration was derived. This mean value was used to obtain the annual average point evapotranspiration as a fraction of the potential value and as a function of dimensionless parameters defining the climate-soil-vegetation system. (See also W79-04037) (Sims-ISWS)
W79-04040

CESSATION OF RETURN FLOW AS A MEANS OF COMPLYING WITH POLLUTION CONTROL LAWS,
For primary bibliographic entry see Field 6E.
W79-04445

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

2E. Streamflow and Runoff

GREEN RIVER BASIN SYSTEMS MODELS - DEVELOPMENT OF SIX-HOUR FLOW RECORDS,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04008

GREEN RIVER DATA BASE SYSTEM,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04009

FLOOD FREQUENCY OF SMALL STREAMS IN ALABAMA,
Geological Survey, University, AL. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04024

FLOOD PROFILES FOR PEACE RIVER, SOUTH-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. R. Murphy, Jr., K. M. Hammett, and C. V. Reeter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 589, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-57, 1978. 35 p, 6 fig, 6 tab, 18 ref.

Descriptors: *Floods, *Flood profiles, *Peak discharge, *Flood recurrence interval, *Backwater, Flood plains, Model studies, Analytical techniques, Regional flood, Forecasting, Evaluation, Florida, *Peace River, *South-central Florida, Polk County, Hardee County, DeSoto County.

This report presents flood heights and profiles for a 70-mile reach of Peace River from Bartow to Arcadia, Fla. The flood heights were calculated using the U.S. Geological Survey step-backwater model. Profiles were prepared for floods having expected recurrence intervals of 2, 2.33, 5, 10, 25, 50, 100, 200, and 500 years. Flood-peak discharges used in the step-backwater analyses were determined by weighting stream gaging-station data with data from a regional analysis. Land-surface elevation data for 183 cross sections - including values of Manning's roughness coefficient - also were used in the backwater analysis. Flood height data are generally accurate to + or - 0.5 foot. They indicate that most roads and two bridges in the study reach will be inundated by some of the floods evaluated. (Woodard-USGS)
W79-04027

CLIMATE, SOIL, AND VEGETATION--5. A DERIVED DISTRIBUTION OF STORM SURFACE RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 741-748, October 1978. 6 fig, 2 tab, 11 ref.

Descriptors: *Runoff, *Surface runoff, *Model studies, Mathematical models, Storms, Storm runoff, Excessive precipitation, Precipitation(Atmospheric), Rainfall, Soils, Soil properties, Infiltration, Statistics, Probability, Temporal distribution, Floods, Flood frequency.

The Philip infiltration equation was integrated over the duration of a rainstorm of uniform intensity to give the depth of point surface runoff from such an event on a natural surface in terms of random variables defining the initial soil moisture, the rainfall intensity, and the storm duration. In a zeroth-order approximation, the initial soil moisture was fixed at its climatic space and time average; whereupon by using exponential probability density functions for storm intensity and duration, the probability density function of point storm rainfall excess was derived. This distribution was used to define the annual average depth of point surface runoff and to derive the flood volume frequency relation, both in terms of a set of physically meaningful climate-soil parameters. (See also W79-04037)(Sims-ISWS)
W79-04041

A MATHEMATICAL MODEL OF MONTHLY FLOW SEQUENCES,
Technical Univ. of Istanbul (Turkey).
Z. Sen.
Hydrological Sciences Bulletin, Vol. 23, No. 2, p 223-229, June 1978. 5 ref.

Descriptors: *Mathematical models, *Time series analysis, *Markov processes, *Model studies, *Theoretical analysis, Hydrology, Mathematical studies, Correlation analysis, Flow, Monthly, Flow sequences, Markov model, Thomas-Fiering model.

A general mathematical model for the generation of synthetic monthly flows was developed. The model preserves the means and standard deviations of monthly flow sequences and the lag-zero cross-correlation between successive months together with the first-order serial correlation of each month. Methodology was suggested for deriving the model parameters. It was shown that the conventional lag-one Markov model and the Thomas-Fiering model are special cases of the model presented. All of the necessary analytical expressions of the correlation structure of the model were derived. Fitting of the model to monthly flow data and the generation of synthetic sequences also were discussed. (Singh-ISWS)
W79-04054

THE EFFECT OF ICE COVER ON VERTICAL TRANFER IN STREAM CHANNELS,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
H. T. Shen, and T. O. Harden.
Water Resources Bulletin, Vol. 14, No. 6, p 1429-1439, December 1978. 6 fig, 1 tab, 22 ref.

Descriptors: *Ice cover, *Mixing, *Channels, *Model studies, Mathematical models, Rivers, Streams, Water pollution, Effluents, Sediments, Sediment transport, Mass transfer, Flow, Dispersion, Hydraulic, Simulation analysis, Ice cover effects.

The effect of ice cover on vertical transfer was examined based on the Reynolds analogy and composite logarithmic velocity distributions. A finite difference scheme was used to predict concentration profiles in a two-dimensional channel. Comparisons made between the ice-covered conditions and the ice-free condition showed that considerable reduction in mixing capacity of the channel is caused by the ice cover. (Sims-ISWS)
W79-04062

IDENTIFICATION AND SEPARATION OF MAJOR BASE FLOW COMPONENTS FROM A STREAM HYDROGRAPH,
Department of the Environment, Reading (England). Central Water Planning Unit.
A. B. Birtles.
Water Resources Research, Vol. 14, No. 5, p 791-803, October 1978. 7 fig, 2 tab, 29 ref.

Descriptors: *Base flow, *Hydrographs, *Model studies, Transpiration, Soil moisture, Aquifers, Recharge, Recession curves, Rivers, Streams, Flow, *Base flow separation, Stream hydrographs, River hydrographs, Lumped parameter hydrological models.

A method was given for the separation of the major base flow components in a river hydrograph using simple models. Simplifying assumptions were made which enable the models to be used without rainfall data if necessary, suitable information being deduced from the river hydrograph. Lumped parameter hydrological models were used for the calculations of actual transpiration, soil moisture deficit, and aquifer recharge rates. The base flow components were identified in terms of a recession time constant, an initial value, and an infiltration contribution. The techniques were applied to the River Severn, for which flow components were separated and then used to illustrate applications to a study of the behavior of conservative water quality determinants. (Lee-ISWS)
W79-04067

A UNIFIED APPROACH TO WATERSHED MODELLING,
Benin Univ. (Nigeria).
For primary bibliographic entry see Field 2A.
W79-04084

MUSKINGUM-CUNGE METHOD WITH VARIABLE PARAMETERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce, and V. Yevjevich.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Technical Note, p 1663-1667, December 1978. 2 fig, 1 tab, 8 ref, 1 append.

Descriptors: *Flood routing, *Flood waves, *Mathematical models, Routing, Analytical techniques, Model studies, Channels, Discharge(Water), Flood flow, Hydrograph analysis, Muskingum-Cunge method.

The Muskingum method and its improved Muskingum-Cunge version are well established in the flood routing literature. The Muskingum method is based on the assumption of a linear relationship between the inflow, I, the outflow, O, and the reach storage, V, of the form $V = K(XI + (1-X)0)$ in which K and X are the parameters. In the conventional Muskingum method, these parameters are determined by calibration using measured inflow and outflow hydrographs. On the other hand, in the Muskingum-Cunge version K and X are calculated using the formulas derived by Cunge. The experience with the Muskingum-Cunge version was reported. It was shown that the way of calculating the parameters has a definite bearing on the overall accuracy of the method. The assumption of constant parameters makes the solution dependent on the reference values chosen to evaluate the parameters. A more physically realistic approach is to consider the parameters K and X to vary in time and space according to the flow variability. A three-point approach and an iterative four-point approach to the calculation of the variable parameters were shown to be sufficiently accurate in the simulation of flood flows. A two-point approach was shown to be inaccurate in the calculation of peak discharge and travel time. Furthermore, the two-point method results in a significant loss of mass. (See also W70-04590)(Humphreys-ISWS)
W79-04122

FLOOD PLAIN INFORMATION: BUXTON CREEK AND TRIBUTARIES, DEQUINCY, LOUISIANA.
Army Engineer District, New Orleans, LA.
Prepared for the City of DeQuincy, LA, October 1972, 29 p, 22 fig, 23 plates, 6 tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Buxton Creek(LA), *DeQuincy(LA), *Peak discharge, Floods, Indirect flood measurement, Historic floods, Flood data, Flood recurrence interval, Flood stages, Flood peak, Flow duration, Stage-discharge relations, Flood protection, Nonstructural alternatives, Warning systems, Control structures, Channel improvement, Standard Project Flood, Intermediate Regional Flood.

The study area is the city of DeQuincy, Louisiana located in the flood plain of Buxton Creek. Buxton Creek has a total drainage area of 63.6 square miles and is a major tributary of the Houston River. The flood plain of Buxton Creek is developed primarily for residential use. All developments in the flood plain, including railroads, highways, streets, public utilities, residences, commercial buildings, and the sewage treatment plant, are subject to flood damage. Flood data were gathered from field surveys, National Weather Service precipitation gages, historical records, and newspaper files. Major floods occur during the summer and fall seasons, resulting primarily from hurricanes and heavy rainfall. The only flood damage reduction measures are two channel improvement projects, completed in 1958, but no maintenance has been done on them since that time. There are no existing zoning ordinances, building codes, or other regulatory measures specifically for the reduction of flood damages. The highest flood of record on Buxton Creek occurred on October 27, 1970, but no streamflow records exist. The Intermediate Regional Flood on Buxton Creek, at Louisiana Highway 27, is forecasted to have a peak discharge of 6,490 cubic feet per second (cfs) and rise to an elevation of 60.3 feet above mean sea level (msl). At the same site, the Standard Project Flood discharge would be 11,500 cfs with a height of 62.3 feet msl. The duration above bankfull stage for the Intermediate Regional Flood would be 14 hours, and for the Standard Project Flood, 21 hours. This report is intended as an aid in the identification of flood damage reduction techniques, both structural and non-structural, and is intended to be used as the basis of a flood plain management program for DeQuincy. (Coan-NC)
W79-04150

FLOOD PLAIN INFORMATION: SIXMILE CREEK--VICINITY OF PUEBLO, COLORADO.
Army Engineer District, Albuquerque, NM.
Prepared for the City and County of Pueblo, CO, April 1976. 28 p, 4 fig, 12 plates, 4 tab.

Descriptors: *Colorado, *Sixmile Creek(CO), *Pueblo(CO), *Flood plain management, *Flood protection, *Non-structural alternatives, *Building codes, *Zoning, *Flooding, Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Flood stages, Peak discharge, Flood peak, Stage-discharge relations, Rivers, Floodways, Flood plain zoning, Warning systems, Land use, Planning, Floodproofing, Arkansas River(NM), Standard project flood, Intermediate regional flood.

The study area is the flood plain of Sixmile Creek, a tributary to the Arkansas River, in the vicinity of Pueblo, Colorado. Other than five bridge crossings, there has been very little development in the flood plain; land use is primarily agricultural. There are no streamgage or discharge records available for Sixmile Creek. Information on the larger aspect of flooding on the Arkansas River was obtained from newspaper files, historical records, and field investigations. Most of the flood-producing storms in the area occur from May through August, resulting from water, moist air from the Gulf of Mexico combining with cold, dry Polar air to produce thunderstorms. The area is also prone to cloudburst-type storms. In the Sixmile Creek basin, there is very little in the way of natural or man-made obstructions. Storm warnings are conducted under the auspices of the Pueblo Civil Defense Agency. The Intermediate Regional Flood and Standard Project Flood are predicted to have peak discharges of 19,379 cubic feet per second (cfs) and 35,655 cfs, respectively. This report is intended to provide information to aid in planning the best use of flood-prone lands and to serve as a tool for flood plain management. Guidelines for flood plain management are presented, with a variety of non-structural alternatives discussed. (Coan-NC)
W79-04151

RECORD FLOODS IN SOUTHWEST VIRGINIA, APRIL 1977.
Virginia State Water Control Board, Richmond; and Virginia Office of Emergency Services, Richmond.
Information Bulletin 527, June 1977, 46 p, 3 tab, 29 plates.

Descriptors: *Floods, *Flash floods, *Flood damage, *Flood flow, *Regional flood, *Flood data, *Flood stages, *Maximum probable flood, Flood plain insurance, Virginia, Flood protection, Flood proofing, Storms.

The April 2-5, 1977 rains brought the worst flooding in history to the ten Southwest Virginia counties of Buchanan, Dickenson, Grayson, Lee, Russell, Scott, Smyth, Tazewell, and Washington. Flooding occurs from the Powell, Clinch, and Guest Rivers, and Levisa Fork, Russell Fork, and Middle Fork. This report assesses the damages and concludes that this area of the state is particularly vulnerable to flooding. Damages were extensive, both to residential structures, with nearly 5,000 homes damaged or destroyed, and to public facilities and agricultural lands. Damages to buildings exceeded $101 million, and the combined damage to wastewater and water treatment plants exceeded $1 million. Recommendations include: elevation of all new structures above the 100-year flood plain and flood-proofing of existing buildings to at least the 100-year flood level; management of flood plains under the new 1977 Virginia Flood Damage Reduction Act, including assistance to political subdivisions and inspections by the State Water Control Board to evaluate enforcement of and compliance with local flood plain management regulations; governmental assistance to citizens in locating their residences; compliance with the provisions of the National Flood Insurance Program; and the need for a significant public relations campaign to alert residents to the dangers of flooding. (Arnold-NC)
W79-04153

UNIT SEDIMENT GRAPH,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-04172

A STORAGE-ROUTING MODEL RELATING DRAINAGE BASIN HYDROLOGY AND GEOMORPHOLOGY,
Wollongong Univ. (Australia). Dept. of Civil Engineering.
M. J. Boyd.
Water Resources Research, Vol. 14, No. 5, p 921-928, October 1978. 6 fig, 7 tab, 35 ref.

Descriptors: *Geomorphology, *Model studies, *Hydrology, *Watersheds(Basins), Networks, Drainage areas, Storage, Routing, Drainage, Time lag, *Storage routing models, Stream order, Network magnitude.

A study of four nested drainage basins was used to measure relations between lag time, stream order, and network magnitude for basins within a larger watershed. Solution of the stream order laws produced a relation between lag time and drainage area which had the same form as the relations developed between different watersheds. A relation between lag time and drainage area was used to allocate storage parameters to the elements of a storage-routing model based on the stream channel network. When it was applied to the most probable stream networks for a given channel magnitude, the model was shown to reproduce relations between lag time and stream order, channel magnitude, and drainage area, having the same form as was observed for the actual drainage basins used in the study. (Lee-ISWS)
W79-04222

HYDRAULIC RESTORATION OF STREAM GRAVEL FOR SPAWNING AND REARING OF SALMON SPECIES,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 8I.
W79-04260

AQUATIC ENVIRONMENTAL ANALYSIS IN THE LOWER YELLOW-STONE RIVER,
Montana Fish and Game Dept., Helena. Ecological Services Div.
For primary bibliographic entry see Field 6G.
W79-04276

A RAINFALL SIMULATOR FOR FIELD STUDIES OF RUNOFF AND SOIL EROSION,
Waite Agricultural Research Inst., Glen Osmond (Australia). Dept. of Agricultural Biochemistry and Soil Science,
For primary bibliographic entry see Field 2B.
W79-04289

SALT PICKUP BY OVERLAND FLOW IN THE PRICE RIVER BASIN, UTAH,
Colorado State Univ., Fort Collins; and Utah State Univ., Logan.
S. L. Ponce, and R. H. Hawkins.
Water Resources Bulletin, Vol. 14, No. 5, p 1187-1200, October, 1978. 5 fig, 2 tab, 10 ref.

Descriptors: *Saline water, *Water pollution sources, *Channel flow, *Shales, *Overland flow, Analytical techniques, Salts, River basins, Tributaries, Utah, Runoff, Water management(Applied).

Described is a field investigation of diffuse source contributions in the Price River Basin, east-central Utah, to determine the processes involving salt pickup associated with overland flow. Results obtained were used in the development of a nonpoint source loading function to predict salt production from diffuse sources as a function of overland flow from the Mancos shale lands of the Price River basin. Data exhibited a high degree of natural variation which precluded the separation of factors affecting salt loading; however, a simplistic nonpoint loading function was developed on empirical concepts and fitted to the data. Application of this function revealed that even under severe conditions, the average annual salt yield to the Price River from overland flow was relatively minor. Nevertheless, attention is called to the fact that these results pertain only to salt concentration of runoff water prior to entering rills and other small micro-channels. As the water mass moved downstream, minute-size shale particles continue dissolving and thus release more salt to the runoff. Recommendations include management practices directed at retaining water on the site, including contour furrowing, chaining, or development of check ponds to deter channel erosion. (Tickes-Arizona)
W79-04298

DETERMINATION OF FLOOD LEVELS ON THE PACIFIC NORTHWEST COAST FOR FEDERAL INSURANCE STUDIES,
CH2M/Hill, Redding, CA.
For primary bibliographic entry see Field 2L.
W79-04359

THE STABILITY OF A TWO LAYER FLOW WITHOUT SHEAR IN THE PRESENCE OF BOUNDARY GENERATED TURBULENCE: FIELD VERIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
For primary bibliographic entry see Field 8B.
W79-04372

MODIFICATION OF THE CHEZY ROUGHNESS COEFFICIENT BY DENSITY STRATIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
For primary bibliographic entry see Field 8B.
W79-04373

DYNAMIC STREAMFLOW-TEMPERATURE SIMULATION APPLIED TO THE BRAZOS-LITTLE RIVERS, TEXAS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5B.
W79-04379

CROSS-SECTION DATA FOR SELECTED PUERTO RICO STREAMS,
Geological Survey, San Juan, PR. Water Resources Div.
E. Colon-Dieppa, and R. Gonzalez.
Geological Survey open-file report 78-882, August 1978. 155 p, 30 fig.

Descriptors: *Floods, *Flood plain zoning, *Flood plain insurance, *Channel morphology, *Puerto Rico, *Cross-sections, *Streams, Flood plains, Planning.

The data presented are for delineating the inundation which could be expected by floods of selected magnitudes in Puerto Rico. These cross section data can be used in Flood Insurance Administration studies and in other studies related to the planning, development, and management of flood plains. The data were collected by the Caribbean District of the Water Resources Division of the U.S. Geological Survey in cooperation with the Puerto Rico Department of Natural Resources. (Woodard-USGS)
W79-04390

DATA FOR FLOODS OF MAY 1978 NORTHEASTERN WYOMING AND SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div., and Geological Survey, Cheyenne, WY. Water Resources Div.
C. Parrett, D. D. Carlson, G. S. Graig, Jr, and J. A. Hull.
Geological Survey open-file report 78-985, November 1978. 16 p, 5 fig, 1 tab, 3 ref.

Descriptors: *Floods, *Montana, *Wyoming, *Flood data, *Peak discharge, Flood frequency, Flood damage, Aerial photography, Hydrographs, Flood stages.

Severe flooding in northeastern Wyoming and southeastern Montana in May 1978 is described by tables of data, graphs, and photographs. Flood peaks were determined at 162 sites in the flooded area. At most of the sites, peak discharges were determined from existing stage-discharge relationship curves, and at 30 of the sites indirect flow measurements were made. At 19 sites, the May 1978 peak discharge exceeded the previous peak of record and also exceeded the computed 100-year frequency flood. (Woodard-USGS)
W79-04396

FLOODS OF SEPTEMBER 1970 IN ARIZONA, UTAH, COLORADO, AND NEW MEXICO,
Geological Survey, Tucson, AZ. Water Resources Div., and Geological Survey, Cheyenne, WY. Water Resources Div.
R. H. Roeske, M. E. Cooley, and B. N. Aldridge.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.75. Geological Survey Water-Supply Paper 2052, 1978. 135 p, 13 fig, 1 plate, 6 tab, 19 ref.

Descriptors: *Floods, *Flood damage, *Rainfall intensity, *Streamflow, *Peak discharge, Storms, River basins, Arizona, Utah, Colorado, New Mexico, *Four Corners area, Pacific storm Norma(1970), Salt River basin, Verde River basin, Dolo River basin, San Juan River basin.

During September 5-7, 1970, unusually large floods occurred in the mountains of central Arizona and in the Four Corners area of Arizona, Utah, Colorado, and New Mexico. Flooding also occurred in southern and northeastern Arizona. The record-high rainfall of September 5 occurred when a mass of moist tropical air from Pacific storm Norma collided with a cold front from the Northwest. The flood took the lives of 23 persons and was reported to have caused about $8.4 million in damages in Arizona. The main area of flooding was in the mountains in central Arizona. The flood generally was less destructive with increasing distance downstream; in the Salt and Verde River basins the reservoirs were capable of storing all the floodwater. Flooding in the Dolores and San Juan River basins in the Four Corners area was mostly in rural areas, and two people were drowned in McElmo Creek in Utah. The flood was not as large as that of October 1911, which is the largest known flood in the area. A second storm occurred in the Four Corners area September 12-14; however, the amount of flooding generally was less than that from the previous storm. Flood damage as a result of the two storms was reported to be about $2.9 million. (Woodard-USGS)
W79-04402

FLOODS OF JULY 19-20, 1977, IN THE JOHNSTOWN AREA, WESTERN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
S. A. Brua.
Geological Survey open-file report 78-963, July 1978. 62 p, 16 fig, 4 tab, 9 ref, append.

Descriptors: *Floods, *Pennsylvania, *Peak discharge, *Flood damage, *Dam failure, Streamflow, Storms, Flood frequency, Flood recurrence interval, Historic floods, Flood control, Flood plains, *Conemaugh River, Johnstown, Western Pennsylvania.

Intense rainfall on the evening of July 19 and early morning hours of July 20, 1977, resulted in moderate to record flooding throughout much of an eight-county area of southwest Pennsylvania. In a 400-square-mile area directly north and east of Johnstown, rainfall totals of 6 to 12 inches were measured in a six to eight-hour period. Flood peaks having recurrence intervals greater than 100 years were recorded at several sites, primarily in the Conemaugh River basin. Runoff rates were as high as 2,390 cubic feet per second per square mile, in a 5.86-square-mile drainage area in the Little Conemaugh River basin. The Conemaugh River at Seward, which drains 715 square miles, had a peak discharge of 161 cubic feet per second per square mile. The flood waters claimed at least 78 lives and caused total losses in excess of $300 million. Also, seven earthfill dams, used mainly for water supply in the Johnstown area, failed. This report describes the storm and the associated flooding. A tabulation of peak gage heights and discharges for the July 1977 flood and for the maximum flood previously known is included for 57 sites. Data pertaining to the dams that failed are included also. (Woodard-USGS)
W79-04413

APPROPRIATION FOR INSTREAM FLOW MAINTENANCE: A PROGRESS REPORT ON 'NEW' PUBLIC WESTERN WATER RIGHTS,
Indiana Univ., Bloomington.
For primary bibliographic entry see Field 6E.
W79-04438

2F. Groundwater

EXTERNAL COSTS OF LAND SUBSIDENCE IN THE HOUSTON-BAYTOWN AREA,
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
J. P. Warren, L. L. Jones, R. D. Lacewell, and W. L. Griffen.
American Journal of Agricultural Economics, Vol. 57, No. 3, p 450-455, August 1975. 2 tab, 9 ref. OWRT A-023-TEX(1).

Descriptors: *Land subsidence, *Groundwater, *Houston-Baytown, *Texas, Aquifer management, Surface waters, Water supply, Water loss, Cost comparisons, Associated costs, Water rates, Cost analysis, Surveys, Groundwater recharge.

Land subsidence along the Texas coast is caused by the withdrawal of groundwater from underground aquifers in excess of natural recharge. A survey of businesses, residences, and public officials was used to estimate the costs of property damage and loss due to land subsidence. The estimated annual subsidence-related costs and losses of $14.6 million were used to evaluate the total costs of supplying water needs to the Houston-Baytown area from two alternative sources. The purchase of all the area's water needs would be justified according to a break-even analysis based on estimated annual subsidence-related costs and current water prices. A higher direct cost to users would result from substituting surface water for groundwater. (Davison-IPA)
W79-04015

HYDROLOGIC EVALUATION OF PART OF CENTRAL VOLUSIA COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-04030

WATER RESOURCES OF CAMAS PRAIRIE, SOUTH-CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
H. W. Young.
Geological Survey Water-Resources Investigations 78-82 (open-file report), 1978. 34 p.

Descriptors: *Groundwater resources, *Pumping, *Water level fluctuations, *Irrigation effects,

*Water quality, Groundwater recharge, Surface-groundwater relationships, Water supply, Water yield, Water utilization, Confined water, Water table aquifers, Idaho, *Camas Prairie.

Ground-water pumpage in Camas Prairie, Idaho, for irrigation and municipal supplies totaled nearly 9,500 acre-feet in 1977. Declines of pressure head in the artesian aquifer have ranged from 3 to 12 feet since 1974 when increased ground-water pumping began. A comparison of water-level measurements made in September 1957 and September 1977 shows declines of more than 30 feet in places in the artesian aquifer. Camas Prairie aquifers are recharged by percolation from streams and by precipitation on the valley floor. Estimated mean annual recharge to the artesian aquifer is 37,000 acre-feet. Vertical recharge from the artesian aquifer to the overlying water-table aquifer is estimated to be 20,000 acre-feet annually. Declines in artesian pressure caused by increased irrigation pumping will result in a reduction of recharge from the artesian aquifer to the water-table aquifer. Yields from irrigation wells in the prairie ranged from 400 to slightly more than 2,000 gallons per minute. Flows in Camas Creek in the 1977 drought year averaged 9,400 acre-feet, compared with 138,000 acre-feet in a normal year. Surface and ground waters sampled in the basin were either a sodium or calcium bicarbonate type water. Dissolved-solids concentrations ranged from 61 to 284 milligrams per liter. (Woodard-USGS)
W79-04031

HYDROGEOLOGY RELATED TO GEOTHERMAL CONDITIONS OF THE FLORIDAN PLATEAU,
Geological Survey, Woods Hole, MA. Water Resources Div., Alabama Univ., Tuscaloosa; and Coastal Petroleum Co., Tallahassee, FL.
F. A. Kohout, H. R. Henry, and J. E. Banks.
Florida Bureau of Geology Special Publication No. 21, p 1-41, 1977. 21 fig, 1 tab, 69 ref.

Descriptors: *Geothermal studies, *Florida, *Injection wells, *Groundwater movement, *Saline water intrusion, Water quality, Aquifers, Water temperature, Data collections, Model studies, Isotherms, Hydrogeology, Saline water-freshwater interfaces, Hot springs, Waste disposal, Gulf of Mexico, *Floridan Plateau, Florida Straits, Floridan aquifer system, Biscayne aquifer, Oil exploratory wells.

Temperature surveys in oil exploratory and waste-injection wells indicate that geothermal gradients underlying the Floridan Plateau are affected by the presence of cold sea water in the adjacent deeps of the Gulf of Mexico and the Florida Straits. The geothermal gradient is negative (the ground water becomes colder) to a depth of about 3,000 feet near the edge of the Plateau. In the horizontal direction, the temperature increases toward the central axis of the Plateau. The horizontal and vertical temperature distributions suggest that cold, dense sea water flows inland through the cavernous dolomite in the deep part of the aquifer where it becomes progressively warmed by geothermal heat flow. The reduction of density produces upward convective circulation. After mixing with fresh water in the upper part of the aquifer, the diluted salt water flows seaward to discharge by upward leakage through confining beds or through submarine springs on the Continental Shelf. The focal point for the deep sea-water flow, and the hottest water, should occur along the central axis of the Floridan Plateau, farthest from the cold sea-water bodies. Upwelling of warm saline water at Warm Mineral Springs sinkhole and the Mud Hole submarine spring near the west coast of Florida provides field evidence that a convective flow cell exists. Mathematical and laboratory model studies demonstrate a remarkable similarity to the patterns of salinity and temperature observed in the field. (Woodard-USGS)
W79-04033

PALEOHYDROLOGY AND MIGRATION OF THE GROUND-WATER DIVIDE IN REGIONS OF TECTONIC INSTABILITY IN ISRAEL,
Geological Survey of Israel, Jerusalem.
U. Kafri, and A. Arad.
Geological Society of America Bulletin, Vol. 89, No. 12, p 1723-1732, December 1978. 9 fig, 1 tab, 34 ref.

Descriptors: *Paleohydrology, *Water table, *Groundwater basins, *Geologic control, *Hydraulic gradient, Sea level, Valleys, Carbonate rocks, Aquifers, Karst, Groundwater recharge, Hydraulic conductivity, *Groundwater divide, *Israel, *Tectonic instability, *Mediterranean Sea, Base level, Structural control.

The Upper Cretaceous Judea carbonate-rock aquifer is situated between the base levels of the Mediterranean Sea in the west and the Jordan rift valley in the east, which have a maximum elevation difference of 400 m. The gradients of the groundwater table vary from very steep (8%) to very moderate (0.04%). The present groundwater divide in the uplifted central Israeli mountains coincides with the north-south structural axis. The divide in the Yizre'el and Beer Sheva morphotectonic valleys, which cut across these mountains, is located very close to the Mediterranean base level. It can be shown, theoretically, that the later subsidence of the rift valley relative to the Mediterranean should have caused a westward shift and a simultaneous lowering of the groundwater divide, as the eastern gradients became more gentle. This is the case in the Yizre'el and Beer Sheva valleys. Although structural control appears to be dominant in the study area, it is recognized that the location of the divide is controlled also by nonuniformity of recharge and hydraulic conductivities. Some of the present water tables have a past history as parts of the paleo-groundwater systems. These are identified on the basis of fossil karst systems and gentle gradients leading to ancient base levels, indicated by nearshore marine or lacustrine sediments. (Visocky-ISWS)
W79-04055

GROUND WATER OF THE ISLAND OF MONTREAL, CANADA,
McGill Univ., Montreal (Quebec). Dept. of Geological Sciences.
R. H. Grice, and M. D. Eggboro.
Water Resources Bulletin, Vol. 14, No. 6, p 1466-1480, December 1978. 8 fig, 4 tab, 19 ref.

Descriptors: *Groundwater, *Water chemistry, *Geology, *Canada, Groundwater movement, Recharge, Groundwater recharge, Natural recharge, Sampling, Data processing, Hydrogeology, Aquifers, Wells, Ions, Cations, Anions, Chemicals, Carbonate rocks, Igneous rocks, Faults(Geologic), *Montreal Island(Quebec).

The geochemistry and nature of the flow of groundwater not only control the supply potential, but also constitute clues to the whole geology of an area. A study was made of the largest available assemblages of data from 161 wells for the Island of Montreal. The data were collected by the Geological Survey of Canada in 1951-53. Data indicated that the system is generally subartesian, flowing from the principal topographically high areas towards the shores of the Island. As the probable use is about 13% of the estimated recharge of 140 million liters per day, most wells could be supplied by local recharge. The study confirmed the predominance of calcium bicarbonate groundwater from the carbonate sequence. The waters appeared to be saturated with respect to $CaCO_3$ in all but 10 wells. The presence of other types of waters suggests the effects of the igneous intrusions of the area, the post-glacial marine submergence, and the upward movement of waters from deep sources through fault and other structural zones. Confirmation of the significant variations in chemical composition in some neighboring wells indicated the future need for repetitive sampling from specific horizons for chemical and isotopic analyses. (Sims-ISWS)
W79-04060

RADIUM-226 IN GROUND WATER OF WEST CENTRAL FLORIDA,
Office of Radiation Programs, Las Vegas, NV.
For primary bibliographic entry see Field 5B.
W79-04065

GRAVITY-INDUCED CROSS-FORMATIONAL FLOW OF FORMATION FLUIDS, RED EARTH REGION, ALBERTA, CANADA: ANALYSIS, PATTERNS, AND EVOLUTION,
Alberta Research Council, Edmonton. Groundwater Div.
J. Toth.
Water Resources Research, Vol 14, No 5, p 805-843, October 1978. 42 fig, 3 tab, 40 ref.

Descriptors: *Groundwater movement, *Groundwater flow, *Gravity, *Canada, Potentiometric level, Water table, Water levels, Depth, Hydrostatic pressure, Hypsometric analysi, Equations, Diffusion, Hydraulic systems, Aquifers, Graphical analysis, Steady flow, *Alberta(Canada), Half-life, Gravity flow, Flow systems, Cross-formational flow.

Three zones of different generations of formation-fluid flow systems were identified from analyses of the potentiometric surface, hypsographic distribution of freshwater heads, pressure-depth relations, water table elevations, and dynamic pressure increments observed in 5 extensive water-bearing units in a 20,400 sq mi geologically mature area in northern Alberta. In each zone, fluids move in gravity-induced flow systems maintained by cross-formational energy transfer and subject to past or present boundary conditions. The force fields and associated flow systems in the basal zone of Middle Devonian aquifers were generated by and adjusted to the topography of the Pliocene continental surface. However, subsequent to the erosional exposure of the sub-Cretaceous unconformity about Pleistocene times, the drainage of the middle zone disrupted the supply of energy from the land surface to the Pliocene flow systems and changed them into slowly decaying relicts of regional fluid dynamics tending toward hydrostatic equilibrium. Solution of the diffusion equation for transient fluid potentials suggests a half-life time of approximately 0.7 m.y. for the excess hydraulic heads in the basal zone, indicating pre-Pleistocene origin for the observed flow distributions in that zone and thus supporting conclusions derived from the steady-state patterns of formation-fluid pressures. (Visocky-ISWS)
W79-04066

IDENTIFICATION AND SEPARATION OF MAJOR BASE FLOW COMPONENTS FROM A STREAM HYDROGRAPH,
Department of the Environment, Reading (England). Central Water Planning Unit.
For primary bibliographic entry see Field 2E.
W79-04067

WELLS AND PONDS: WATER QUALITY AND SUPPLY,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3C.
W79-04068

DETERMINATION OF AQUIFER DIFFUSIVITY FROM ANNUAL FLUCTUATIONS OF GROUND WATER LEVELS,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
K. Ambo.
Nordic Hydrology, Vol. 9, No. 3/4, p 187-196, 1978. 7 fig, 5 ref.

Descriptors: *Groundwater, *Water levels, *Diffusivity, *Model studies, Mathematical models, Fluctuations, Water level fluctuations, Aquifers, Wells, Water wells, Drawdown, Infiltration, Recharge, Natural recharge, Piezometry, Permeability, Hydrology.

Annual fluctuations of groundwater levels of an aquifer were described as a consequence of water recharging periodically over a part of the aquifer.

These areas can be depicted by drawing maps showing the areal amplitude distribution of the oscillation. Considering these areas as periodic (in time) surface sources, the damping and the phase of the oscillation were found analytically as functions of distance, the recharge areas being an infinite strip or a circular disc. From these solutions, the aquifer diffusivity can be calculated by the use of typecurves. (Sims-ISWS)
W79-04069

A FINITE ELEMENT AQUIFER MODEL WHICH TAKES INTO ACCOUNT ELEVATION CHANGES OF THE AQUIFER,
Helsknki Univ. of Technology, Otaniemi (Finland). Dept. of Civil Engineering.
. Aalto.
Nordic Hydrology, Vol. 9, No. 3/4, p 173-186, 1978. 13 fig, 10 ref.

Descriptors: *Aquifers, *Drawdown, *Water levels, *Model studies, Mathematical models, Finite element analysis, Groundwater, Groundwater movement, Computer models, On-site investigations, Pumping, Wells, Water wells, Water table, Analytical techniques.

A finite element formulation, which takes into account elevation changes, was presented for confined aquifer flow. The middle surface of the aquifer was assumed not as a horizontal plane but as a curved surface. The theory of isoparametric finite elements was applied to develop a general isoparametric surface element for the problem. The presented technique, with little additional programming effort, can be incorporated into any standard finite element computer program for solving the two-dimensional, quasi-harmonic differential equaton (i.e., equation governing heat conduction, electric potential, and seepage through porous media, etc.). A computer program using a four node quadrilateral surface element was developed. Some results of two examples analyzed using this program were established. (Sims-ISWS)
W79-04083

HYDRAULIC AND ELECTRO-OSMOTIC PERMEABILITY COEFFICIENTS,
Wisconsin Univ. Milwaukee. Dept. of Civil Engineering.
P. N. Sundaram.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol. 105, No. GT1, Technical Note, p 89-92, January 1979. 2 fig, 5 ref, 2 append.

Descriptors: *Electro-osmosis, *Permeability, *Soil properties, *Porous media, Hydraulic conductivity, Measurement, Testing procedures, Analytical techniques, Laboratory tests.

A knowledge of hydraulic and electro-osmotic permeability coefficients is required to assess the amount and time rate of consolidation by electro-osmosis. Usually, the coefficients are determined separately. In one method, the pore water is allowed to rise in a vertical tube at the open cathode under a constant voltage gradient. The final electro-osmotic equilibrium head at the cathode is used to estimate the electro-osmotic permeability from a knowledge of the hydraulic permeability coefficient. An approximate method of estimating both the hydraulic and electro-osmotic permeability coefficients from the water rise versus time readings in one-dimensional flow test under constant voltage gradient was presented. With this method, it is also possible to estimate the final electro-osmotic equilibrium head, without prolonging the test for many days. (Humphreys-ISWS)
W79-04092

AN ITERATIVE QUASI-THREE-DIMENSIONAL FINITE ELEMENT MODEL FOR HETEROGENEOUS MULTIAQUIFER SYSTEMS,
Waterloo Univ. (Ontario).
D. W. Chorley, and E. O. Frind.
Water Resources Research, Vol. 14, No. 5, p 943-952, October 1978. 11 fig, 2 tab, 27 ref, 1 append.

Descriptors: *Aquifers, *Aquifer systems, *Aquitards, *Model studies, Mathematical models, Finite element analysis, Equations, Groundwater, Wells, Water wells, Groundwater movement, Hydraulic properties, Analytical techniques, Hydrology, Aquitard leakage.

A quasi-three-dimensional flow model was developed for the analysis of hydrogeologic systems consisting of several aquifers interconnected by aquitards. Provided only that each layer is continuous within the domain and that a permeability contrast of 2 orders of magnitude or more exists between adjoining layers, a system can be completely hetergeneous. Also, any of the aquifers can be pumped, and discharge rates can be arbitrary. Flexibility was achieved by utilizing finite element discretizations for aquifers as well as aquitards. The solution is iterative, aquifers and aquitards being solved separately and coupling being provided through the leakage flux. Aquitard storage and interaction between aquifers are rigorously accounted for at all times. Convergence was demonstrated experimentally by comparison with the analytial solution of Neuman and Witherspoon. The multiaquifer model was shown to be much more economical than an equivalent three-dimensional model. (Sims-ISWS)
W79-04125

A NOTE ON PACKER, SLUG, AND RECOVERY TESTS IN UNCONFINED AQUIFERS,
Tel Aviv Univ. (Israel). School of Engineering.
G. Dagan.
Water Resources Research, Vol. 14, No. 5, p 929-934, October 1978. 3 fig, 1 tab, 4 ref.

Descriptors: *Wells, *Testing, *Aquifers, Water wells, Numerical analysis, Computer programs, Mathematical models, Model studies, Hydraulic conductivity, Permeability, Groundwater, Water table, Hydrology, Recovery tests, Packer tests, Slug tests.

Packer, slug, and recovery tests are common procedures for determining the hyrdaulic conductivity of unconfined formations of low permeability. The volumes of water injected or removed from the borehole are small, so that the water table remains horizontal and the flow is steady. The flow problem by source distributions along the well axis. A simple numerical method and numerical results covering a wide range of the parameters of the problem were presented. The main limitation of the method is the requirement that the active portion of the well length should be much larger (say, 50 times) than the well radius. (Sims-ISWS)
W79-04128

THREE-DIMENSIONAL MODELING OF GROUNDWATER FLOW SYSTEMS,
Waterloo Univ., (Ontario). Dept. of Earth Sciences.
E. O. Frind, and M. J. Verge.
Water Resources Research, Vol. 14, No. 5, p. 844-856, October 1978. 15 fig, 3 tab, 30 ref, 1 append.

Descriptors: *Groundwater movement, *Mathematical models, *Finite element analysis, Equations, Saturated flow, Unsaturated flow, Continuity equation, Numerical analysis, Costs, Hydraulic conductivity, Porosity, Compressibility, Model studies, *Three-dimensional modeling, Galerkin technique.

Practical aspects of three-dimensional (3-D) modeling of groundwater flow systems were examined closely. A Galerkin finite element model was designed with a view to providing flexibility, user convenience, and a high degree of efficiency, qualities which are critical to the success of 3-D modeling of real systems. The model was based on the general saturated-unsaturated continuity equation. Several integration schemes and matrix solvers were compared, and relative costs were expressed as functions of grid size. Examples presented included a hypothetical system and a real system. Simulation costs generally were found to be reasonable for grids of the size encountered with real systems. It was found that a remaining obstacle to the unified treatment of saturated-unsaturated systems is that the optimum element sizes required for saturated and unsaturated flow are not always compatible because of constraints arising from the physical properties of the materials. In general, however, it appears that with presently available tools, 3-D analysis is a practical option. (Visocky-ISWS)
W79-04149

FINITE ELEMENT METHOD FOR SUBSURFACE HYDROLOGY USING A MIXED EXPLICIT-IMPLICIT SCHEME,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan, S. P. Neuman, and P. A. Witherspoon.
Water Resources Research, Vol. 14, No. 5, p 863-877, October 1978. 19 fig, 2 tab, 32 ref, 2 append.

Descriptors: *Groundwater, *Subsurface flow, *Model studies, Mathematical models, Subsurface drainage, Groundwater movement, Aquifers, Finite element analysis, Mathematics, Equations, Storage, Wells, Drawdown, Hydraulic conductivity, Hydrology.

The mixed explicit-implicit Galerkin finite element method developed previously was shown to be ideally suited for a wide class of problems arising in subsurface hydrology. These problems include confined saturated flow, unconfined flow uner free surface condtions subject to the Dupuit assumption, flow in aquifers which are partly confined and partly unconfined, axisymmetric flow to a well with storage, and flow in saturated-unsaturated soils. A single computer program, entitled Flump, can now handle all of these problems. The mixed explicit-implicit solution strategy employed in the program insures a high level of accuracy and computation efficiency in most cases. It eliminates many of the difficulties that groundwater hydrologists have been encountering in trying to simulate extensive aquifer system by finite elements. Some of the outstanding features of this solution strategy include an automatic control of time step size, reclassification of nodes from explicit to implicit during execution, automatic adjustment of the implicit time-weighting factor, and the treatment of bounary conditions and source terms as arbitrary functions of time of the state of the system. Five examples were presented to demonstrate the versatility and poer of this new approach. A purely physical derivation of the finite element equations which does not rely on the Galerkin formalism also was included in one of the appendices. (Sims-ISWS)
W79-04163

HYDRAULICS IN THE COASTAL ZONE.
For primary bibliographic entry see Field 2L.
W79-04351

THE FRESH WATER LENS IN A BARRIER BEACH,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2L.
W79-04367

EVALUATION OF A BARRIER AGAINST SEAWATER INTRUSION,
Los Angeles County Flood Control District, CA.
For primary bibliographic entry see Field 2L.
W79-04370

GROUNDWATER-SURFACE WATER RELATIONSHIP NEAR LAKE MICHIGAN SHORE,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W79-04371

HYDROLOGIC INFORMATION FOR LAND-USE PLANNING, FAIRBANKS VICINITY, ALASKA,
Geological Survey, Anchorage, AK., Water Re-

sources Div.
G. L. Nelson.
Geological Survey open-file report 78-959, 1978. 47 p, 16 fig, 50 ref.

Descriptors: *Groundwater availability, *Water quality, *Water pollution sources, *Groundwater movement, *Surface-groundwater relationships, Transmissivity, Water table, Land use, Planning, Hydrologic data, Alaska, *Fairbanks area.

The flood plain on the Chena and Tanana Rivers near Fairbanks, Alaska, has abundant water in rivers and in an unconfined alluvial aquifer. The principal source of ground water is the Tanana River, from which ground water flows northwesterly to the Chena River. Transmissivity of the aquifer commonly exceed 100,000 sq ft. The shallow water table (less than 15 ft below land surface), high hydraulic conductivity of the sediments and cold soil give the flood plain a high susceptibility to pollution by onsite sewerage systems. The Environmental Protection Agency recommended maximum concentrations for drinking water may be exceeded in surface water for manganese and bacteria and in ground water for iron, manganese, and bacteria. Residents of the uplands obtain water principally from a widely-distributed fractured schist aquifer. The aquifer is recharged by local infiltration of precipitation and is drained by springs on the lower slopes and by ground-water flow to alluvial aquifers of the valleys. The annual base flow from basins in the uplands ranged from 3,000 to 100,000 gallons per acre; the smallest base flows occur in basins nearest the city of Fairbanks. The thick silt cover and great depth to the water table give much of the uplands a low susceptibility to pollution by onsite sewage disposal. Ground water is locally high in nitrate, arsenic, iron, and manganese. (Woodard-USGS)
W79-04391

WATER LEVELS IN ARTESIAN AND NONARTESIAN AQUIFERS OF FLORIDA, 1975-76,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. G. Healy.
Geological Survey open-file report 78-458, May 1978. 115 p, 54 fig, 1 tab, 3 ref.

Descriptors: *Groundwater resources, *Water levels, *Florida, *Aquifer characteristics, Observation wells, *Drawdown, Pumping, Groundwater recharge, Water level fluctuations, Hydrographs.

On the basis of measurements in 664 selected wells from a network total of about 2,100 observation wells, ground-water levels during May 1975-May 1976 declined from 2 to 4 feet in the Floridan aquifer throughout most of north and central peninsular Florida. Hydrographs of 60 wells show that the downward trends of ground-water levels continued in several areas of heavy pumping. The most notable area was in west-central Polk County where levels declined to new record lows in 1975 and 1976. In northwest Florida, declines ranged from less than 1 foot to 2 feet in the sand-and-gravel aquifer. In the northeastern, eastern and southwestern coastal parts of the State, levels declined to new record lows. (Woodard-USGS)
W79-04404

FREELAND V. DICKSON (LOWER LANDOWNER HAS NO RIGHT TO UNIMPEDED FLOW OF SURFACE WATER ONTO HIS LAND),
379 N.E. 2d 903-07 (111. Ct. App. 1978).

Descriptors: *Natural flow, *Surface waters, *Illinois, *Drainage, Adjacent land owners, Water control, Drainage, Flow, Culverts, Hydraulics, Agriculture, Water rights.

Plaintiffs, owners of land lying to the west of a highway culvert, sought to compel the defendant, owner of land lying east of the culvert, to remove artificial obstructions on the defendant's land which were impeding the natural flow of surface waters from plaintiffs' to defendant's land. The trial court issued a mandatory injunction and ordered the defendant to remove the obstructions. Defendant appealed. The Appellate Court held that ordering the removal of the obstructions was proper because under state law, where water from one tract of land falls naturally upon the land of another, the owner of the lower land must suffer the water to be discharged upon his land and has no right to stop or impede the natural flow of the surface water. However, the court refused to uphold portions of the order which required the defendant to excavate or lower the existing natural course of surface drainage and which required the plaintiffs to restore the level of natural drainage on their own land to a certain prior level. These parts of the order were deemed contrary to law. (Hucks-Florida)
W79-04434

HUELSMANN V. STATE (RECOVERY DENIED FOR LOSS OF WELL WATER CAUSED BY HIGHWAY CONSTRUCTION).
381 N.E. 2d 950-55 (Ohio Ct. App. 1977).

Descriptors: *Water loss, *Percolating water, *Wells, *Ohio, Subsurface waters, Groundwater, Base flow, Percolation, Water rights, Remedies, Damages, Alteration of flow.

Plaintiff property owners brought an action against defendant Ohio Department of Transportation, seeking damages for the complete loss of water in their well caused by highway construction. The State claimed plaintiffs' loss of subsurface or ground water which supplied the well constituted an injury without legal remedy because no action at law can lie for loss of percolating waters. The Ohio Court of Appeals, found that rights of ownership in subterranean waters arise to the same extent as exists between riparian owners of surface water, but only if the underground streams of water flow in well defined and well known channels which can be traced. Thus, one court held: the State was not liable to the property owner for the impairment or destruction of the use of the well water; the property owner was not entitled to direct or consequential damages for the injury; and further, the state had not duty to provide prior notice of impending damages. Additionally, since the waters in question were percolating waters, there were no material issues of genuine fact, so the trial court's summary judgement was upheld. (Rule-Florida)
W79-04456

THE USE OF BOUNDING WELLS TO COUNTERACT THE EFFECTS OF GRAVITY IN DIPPING AQUIFERS,
Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
For primary bibliographic entry see Field 4B.
W79-04496

2G. Water In Soils

THE COMPLEXING AND ADSORPTION OF CADMIUM IN SOILS IN THE PRESENCE OF EDTA AND NTA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W79-04007

CLIMATE, SOIL, AND VEGETATION--1. INTRODUCTION TO WATER BALANCE DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04037

CLIMATE, SOIL, AND VEGETATION--3. A SIMPLIFIED MODEL OF SOIL MOISTURE MOVEMENT IN THE LIQUID PHASE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 722-730, October 1978. 13 fig, 15 ref.

Descriptors: *Soil water movement, *Soil moisture, *Model studies, Mathematical models, Infiltration, Percolation, Capillary water, Capillary fringe, Soils, Soil properties, Hydraulic conductivity, Pore water, Pores, Wetting, Drying, Precipitation(Atmospheric), Evapotranspiration, Soil water.

Natural soil systems were modeled one dimensionally from the surface to a stationary water table by a homogeneous medium defined by three independent parameters. Four varieties of soil moisture movement were anlyzed separately, and their effects were linearly superimposed. Infiltration and exfiltration were described by the Philip equation, which assumes the medium to be effectively semi-infinite, and the internal soil moisture at the beginning of each storm and interstorm period was assumed to be uniform at its long-term space-time average. The exfiltration equation was modified for the presence of natural vegetation through the approximate introduction of a distributed sink representing the moisture extraction by plant roots. Gravitational percolation to groundwater was assumed to be steady throughout the rainy season at a rate determined by the long-term space-time average soil moisture. Capillary rise from the water table was assumed to be steady throughout the year and to take place to a dry surface. (See also W79-04037) (Sims-ISWS)
W79-04039

CLIMATE, SOIL, AND VEGETATION--6. DYNAMICS OF THE ANNUAL WATER BALANCE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04042

CLIMATE, SOIL, AND VEGETATION--7. A DERIVED DISTRIBUTION OF ANNUAL WATER YIELD,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04043

EFFECT OF ENTRAPPED SOIL AIR ON INFILTRATION,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
A. R. Jarrett, and D. D. Fritton.
Transactions of the American Society of Agricultural Engineers, Vol. 21, No. 5, p 901-906, September--October 1978. 11 fig, 2 tab, 11 ref.

Descriptors: *Air entrainment, *Soil water, *Infiltration, Soil water movement, Hydraulic gradient, Soil profiles, Darcys law, Hydraulic conductivity, Mathematical models, Equations, Wetting, Pressure, Loam, Model studies, Trapped air, Soil air.

During a rainfall event, water at the soil surface can either infiltrate into the soil or become runoff. The rate at which water enters the soil often is assumed to occur independently of the disposition of the soil air contained in the unsaturated medium. If, however, conditions are such that the air cannot escape, it will be trapped within the soil profile ahead of the infiltrating front. As the infiltration process continues, the trapped air compresses; and the increased air pressure reduces the hydraulic head gradient driving the infiltration process and reduces the infiltration rate. The pressure of the trapped air within the soil profile increases until the internal pressure reaches a certain value, where the air can escape through the surface via large pores. This reduces the air pressure and allows infiltration to continue at an increased rate. (Visocky-ISWS)
W79-04124

THE ROLE OF NITRATE DIFFUSION IN DETERMINING THE ORDER AND RATE OF

ENITRIFICATION IN FLOOD SOIL: I. EXERIMENTAL RESULTS,
orth Carolina State Univ. at Raleigh. Dept. of iological and Agricultural Engineering.
. R. Reddy, W. H. Patrick, Jr., and R. E. Phillips.
oil Science Society of America Journal, Vol. 42, o. 2, p 268-272, March-April, 1978. 5 fig, 3 tab, 3 ref.

escriptors: *Denitrification, Nitrates, Anaerobic onditions, Flooding, Submergence, Nitrogen, Difsion, Incubation.

ifteen soils from various locations in the U.S. ere amended with 0.5% rice straw and incubated nder saturated conditions without O2, either with o excess floodwater or with a 3-cm overlying ayer of floodwater. The disappearance of added nd native NO3(-)-N and its conversion to N2 and 2O followed apparent zero-order reaction kinetcs when all the NO3(-)-N was present in the active oil layer (no excess floodwater). When added O3(-)-N was present in both the floodwater and ne soil layer, NO3(-)-N disappearance followed pparent first-order reaction kinetics. A decrease in O3(-)-N concentration in the soil layer caused O3(-)-N in the floodwater to diffuse into the soil ayer (a first-order reaction with respect to NO3(-)-N concentration) where it was denitrified. The rate f denitrification was faster in soils incubated with o excess floodwater compared to soils incubated nder 3 cm of floodwater. One soil (Crowley silt oam), when incubated with no added carbon ource and no excess floodwater, showed (NO3(-)-N disappearance to follow first-order kinetics. When this soil was incubated with an additional arbon souce, NO3(-)-N disappearance was zero rder. (See also W79-04131) (Skogerboe-Colorado tate)
W79-04130

HE ROLE OF NITRATE DIFFUSION IN DETERMINING THE ORDER AND RATE OF ENITRIFICATION IN FLOODED SOIL: II. HEORETICAL ANALYSIS AND INTERPRETATION,
Kentucky Univ., Lexington. Dept. of Agronomy.
R. E. Phillips, K. R. Reddy, and W. H. Patrick, Jr.
Soil Science Society of America Journal, Vol. 42, No. 2, p 272-278, March-April, 1978. 7 fig, 13 ref, ppend.

Descriptors: Denitrification, Nitrates, Flooding, Submergence, Nitrogen, Diffusion, Theoretical nalysis.

A theoretical analysis of denitrification occurring n submerged soil in a test tube, when assumed to e a zero-order reaction with available organic carbon nonlimiting, appears to be a first-order reaction if the effects of diffusion are neglected. This s so because denitrification occurs at a faster rate than the diffusive flux can supply NO3(-)-N to the soil. After some length of time, the concentration of NO3(-)-N in the lower portion of the floodwater-soil interface will be equal to the concentration in the flood-water. After which time, denitrification occurs only in the upper portion of the soil sample. It is suggested that the true order of reaction and rate constant of denitrification in a test tube can be evaluated experimentally by eliminating the floodwater above the soil sample; with this experimental geometry some of the confounding effects of diffusion of NO3(-)-N can be minimized. If diffusion is neglected, not only is the order of reaction misjudged but the depth of floodwater above the soil has a significant effect on the magnitude of the calculated rate constant of the apparent first-order reaction also. (See also W79-04130) (Skogerboe-Colorado State)
W79-04131

THE DEPENDENCE OF THE PARAMETERS IN THE GREEN AND AMPT INFILTRATION EQUATION ON THE INITIAL WATER CONTENT IN DRAINING AND WETTING STATES,
Cambridge Univ. (England). Dept. of Applied Biology.
S. Aggelides, and E. G. Youngs.
Water Resources Research, Vol. 14, No. 5, p 857-862, October 1978. 10 fig, 1 tab, 22 ref.

Descriptors: *Infiltration, *Equations, *Mathematical studies, *Soil water movement, Moisture content, Drainage, Wetting, Sand, Model studies, Theoretical analysis, Pressure head, Soil physical properties, Hysteresis, Green and Ampt equation, Richards equation, Wetting front.

The parameters in the Green and Ampt infiltration equation were determined from infiltration experiments in a sand column at various uniform initial water contents in both draining and wetting states. The parameters were compared with various estimates obtained from the soil water properties measured on the same experimental column. The estimates of the soil water pressure head at the wetting front were generally more negative than the values obtained from the directly measured parameters. It was found that the calculated cumulative infiltration as a function of time was fitted better by using Bouwer's crude 'water entry' estimate than values deduced by approximating Richards' flow equation. (Visocky-ISWS)
W79-04155

EFFECTS OF SOLUTION CHEMISTRY AND ENVIRONMENTAL CONDITIONS ON AMMONIA VOLATILIZATION LOSSES FROM AQUEOUS SYSTEMS,
International Fertilizer Development Center, Florence, AL. Agro-Economic Div.
For primary bibliographic entry see Field 2K.
W79-04180

TRANSIENT CHANGES IN THE SOIL-WATER SYSTEM FROM IRRIGATION WITH SALINE WATER: I. THEORY,
California Univ., Riverside. Dept. of Soil and Environmental Science.
W. A. Jury, H. Frenkel, and L. H. Stolzy.
Soil Science Society of America Journal, Vol. 42, No. 4, p. 579-585, July-August, 1978. 5 fig, 5 tab, 15 ref, 11 equ.

Descriptors: *Saline water, *Soil water movement, Chemical precipitation, Leaching, Diffusion, Travel time, *Cation exchange, Dispersion, *Irrigation water, *Soil-water interfaces.

Transient soil solution concentrations and salt precipitation rates in the root zone are shown to be influenced by the ion composition and concentration of the applied water and soil exchange complex as well as by the water uptake distribution and infiltration rate. Calculations are performed on three kinds of infiltration water to estimate the ionic composition of the soil solution, the rate of gypsum and CaCO3 precipitation, and the time to reach steady state for a given irrigation management. Solution concentrations adjusted for exchange interactions were shown to precipitate twice the quantity of salt in a given time, resulting in lowered solution concentration and altered composition of Ca(2+), Mg(2+), Na(2+), and SO4(2-) ion concentrations in the solution phase, with up to 1,600 days required to reach steady state through the top 150 cm for a leaching fraction of 0.05. The extent of precipitation is also found to depend strongly on the concentration of sulfate and degree of saturation with gypsum in the irrigation water. Diffusion and dispersion are also shown to influence the duration of the transient phase. (Skogerboe-Colorado State)
W79-04202

SURFACE CHARGE MANIPULATION OF CONSTANT SURFACE POTENTIAL SOIL COLLOIDS: I. RELATION TO SORBED PHOSPHORUS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 2K.
W79-04203

FACTORS AFFECTING DENITRIFICATION IN A SONORAN DESERT SOIL,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04204

TRANSIENT CHANGES IN THE SOIL-WATER SYSTEM FROM IRRIGATION WITH SALINE WATER: II. ANALYSIS OF EXPERIMENTAL DATA,
California Univ., Riverside. Dept. of Soil and Environmental Science.
W. A. Jury, H. Frenkel, D. Devitt, and L. H. Stolzy.
Soil Science Society of America Journal, Vol. 42, No. 4, p 585-590, July-August, 1978. 4 fig, 7 tab, 13 ref, 3 equ.

Descriptors: *Saline water, *Soil water movement, Cation exchange, Chemical precipitation, Solutes, *Irrigation water, Wheat, Sorghum, Lysimeters, *Soil-water interfaces.

Twenty-three lysimeters containing four soil types with alternate wheat (Triticum aestivum L.) and sorghum (Sorghum vulgare Pers.) crops were irrigated with three synthesized levels (2.2, 3.9, 7.1 mmho/cm) of irrigation water. Salt balance was calculated from soil salinity sensor electrical conductivity EC measurements by determining a relationship between solution EC and solution concentration using a chemical equilbrium model. Exchangeable cations were measured after the third crop. All methods of determining salt balance showed the order of 50% salt precipitation over the first 500 days of the experiment, approximately two times the expected amount when root zone salt concentrations have reached steady state. Release of Ca(2+) ions from exchange sites and subsequent enhanced gypsum and Ca CO3 precipitation was assumed to be responsible for the difference between transient and steady-state behavior. The drainage composition of a lysimeter which had moved one pore volume through the root zone showed that only Cl(-) was approaching a steady-state value. Exchange effects and enhanced precipitation were assumed to be buffering the concentration of the other ions. Water uptake in all lysimeters was occurring primarily in the top 20 cm, a consequence of high irrigation water salinity and daily irrigation. (Skogerboe-Colorado State)
W79-04205

PHOSPHATE DESORPTION FROM KAOLINITE SUSPENSIONS,
Volcani Inst. fo Agricultural Research, Bet-Dagan (Israel). Div. of Soil Chemistry and Plant Nutrition.
For primary bibliographic entry see Field 2K.
W79-04207

THERMODYNAMICS OF POTASSIUM-CALCIUM AND MAGNESIUM-CALCIUM EXCHANGE REACTIONS ON A KAOLINITIC SOIL CLAY,
Ibadan Univ. (Nigeria) Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04209

ATRAZINE MOBILITY IN TWO SOILS UNDER CONVENTIONAL TILLAGE,
Pennsylvania Agricultural Experiment Station, University Park. Dept. of Soil Chemistry and Weed Science.
J. K. Hall, and N. L. Hartwig.
Journal of Environmental Quality, Vol. 7, No. 1, p 63-68, January-March, 1978. 7 tab, 20 ref.

Descriptors: Pesticides, Herbicides, *Leaching, Lysimeters, Bioassay, *Soil contamination, *Atrazine.

Atrazine mobility was studied in two differenct Pennsylvania soils under conventional tillage. Atrazine mobility, dissipation rate, and residual activity were evaluated by chemical analysis and oat bioassay of soil cores sampled at 15-cm increments to 122 cm and from chemical analysis of suction lysimeter leachates. It appeared from this study that application of atrazine to fine-textured,

conventionally tilled soils at rates ranging from 1.0 to 4.5 kg/ha would not seriously affect ground water supplies through contamination by internal soil damage. (Skogerboe-Colorado State)
W79-04212

IMPORTANCE OF THE ORGANIC PHOSPHORUS FRACTION IN EXTRACTS OF CALCAREOUS SOIL,
Cotton Research Center, Phoenix, AZ.
For primary bibliographic entry see Field 2K.
W79-04213

ADSORPTION OF ALDICARB BY CLAYS AND SOIL ORGANO-CLAY COMPLEXES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Science.
For primary bibliographic entry see Field 2K.
W79-04217

MULTICOMPONENT CATION ADSORPTION DURING CONVECTIVE-DISPERSIVE FLOW THROUGH SOILS: EXPERIMENTAL STUDY,
Utah State Univ., Logan. Dept. of Soils and Biometeorology.
For primary bibliographic entry see Field 2K.
W79-04218

THE AUTOMATIC DETERMINATION OF PPB LEVELS OF AMMONIA, NITRATE PLUS NITRITE, AND PHOSPHATE IN WATER IN THE PRESENCE OF ADDED MERCURY (II) CHLORIDE,
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Soils.
For primary bibliographic entry see Field 2K.
W79-04226

A NEW APPROACH TO SOIL TESTING: III. DIFFERENTIAL ADSORPTION OF POTASSIUM,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04227

COLORIMETRIC DETERMINATION OF UREA IN SOIL EXTRACTS USING AN AUTOMATED SYSTEM,
Melbourne Univ., Parkville (Australia). Faculty of Agriculture and Forestry.
For primary bibliographic entry see Field 2K.
W79-04228

A KINEMATIC MODEL FOR SURFACE IRRIGATION,
New Mexico Inst. of Mining and Technology, Socorro.
B. Sherman, and V. P. Singh.
Water Resources Research, Vol. 14, No. 2, p 357-364, April, 1978. 10 fig, 41 ref.

Descriptors: *Surface irrigation, Mathematical models, Analytical techniques, *Infiltration, Hydrodynamics, Momentum equation.

A kinematic wave model is developed to study surface irrigation. Depending on the variability of infiltration and the kinematic wave friction parameter, three cases are distinguished. Explicit analytical solutions are obtained for the case when infiltration is constant, and a possible approach is suggested for the case when it is not. (Skogerboe-Colorado State)
W79-04230

ON OSCILLATION OF NUMERICAL SOLUTION OF A MODIFIED RICHARDS' EQUATION,
Utah International Inc., San Francisco, CA. Dept. of Environmental Quality.
N. Krishnamurthi, D. K. Sunada, and R. A. Longenbaugh.
Water Resources Research, Vol. 14, No. 1, p 52-54, February, 1978. 1 fig, 16 ref, 8 equ.

Descriptors: *Mathematical studies, Numerical analysis, *Soil water movement, *Hydraulic conductivity, Gravitational water, Diffusivity.

Numerical solutions of differential equations should be checked for the conditions of consistency, convergence, and stability. The implicit solutions that satisfy these conditions are sometimes found to be oscillatory about the true solutions. The reasons for these oscillations are explained. A method to derive criteria for nonoscillatory solutions of a nonlinear partial differential equation is outlined. These criteria for modified Richards' equation are presented, and their physical significances are explained. (Skogerboe-Colorado State)
W79-04231

DENITRIFICATION IN FOUR CALIFORNIA SOILS: EFFECT OF SOIL PROFILE CHARACTERISTICS,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
J. W. Gilliam, S. Dasberg, L. J. Lund, and D. D. Focht.
Soil Science Society of America Journal, Vol. 42, No. 1, p 61-66, January-February, 1978. 4 fig, 3 tab, 25 ref.

Descriptors: *Denitrification, *Soil profiles, Steady flow, Soil water movement, Nitrates.

The effects of soil profile characteristics upon rate and products of denitrification were investigated using four soils in laboratory columns under steady-state water flow conditions. Soils with heavy textured subsoils readily reduced added NO3(-). However, the soil with the lowest clay content had restricted water flow in the surface horizon and reduced the greatest amount of NO3(-). It was concluded that any soil condition which impedes water flow will be positively related to denitrification and that spatial variability in denitrification is likely to be as great as observed variability in water movement. The ratio of N2 to N2O found during denitrification was extremely variable with measured values from 100:1 to 1:4. The low concentrations of N2O measured during denitrification occurred in soils where the denitrification was occurring deep in the soil profile, but there was no indication that this low concentration was a result of further reduction of N2O as N2O diffused through the soil profile. Our data indicate that it is currently not possible to accurately predict relative amounts of N2 and N2O which will be produced during most denitrification in soils, and that estimates of that N2O produced from agricultural lands have a large uncertainty factor. (Skogerboe-Colorado State)
W79-04234

EXTRACTABILITY OF 238PU AND 242CM FROM A CONTAMINATED SOIL AS A FUNCTION OF PH AND CERTAIN SOIL COMPONENTS: HNO3-NAOH SYSTEM,
California Univ., Los Angeles, Lab. of Nuclear Medicine and Radiation Biology.
H. Nishita, M. Hamilton, and A. J. Steen.
Soil Science Society of America Journal, Vol. 42, No. 1, p 51-56, January-February, 1978. 3 fig, 3 tab, 37 ref.

Descriptors: *Soil contamination, Pollutants, *Radioactivity, Nitrates, *Organic matter, Iron oxides, Hydrogen ion concentration, Silica, Ion exchange, Sorption.

The study involved an equilibrium batch technique using HNO3-NaOH extracting system. The influence of various soil components on 238Pu and 242Cm extractability was determined indirectly by selectively removing them from the soil. Soil organic matter, free iron oxides, and free silica, alumina, and amorphous alumino-silicates influenced the chemical extractability of 238Pu and 242Cm. The influence of these soil components depended on the pH of the soil suspension. Below pH close to 4.5, 238Pu appeared to be more strongly sorbed on the mineral fraction of the soil than 242Cm, but above pH close to 4.5, both were strongly sorbed on the mineral fraction. With the contaminated virgin soil, the 238Pu and 242Cm extractability ranged from 4.82 to 53.05% and 0.15 to 64.58% of dose, respectively, depending on the pH of the extracting solution. The lowest extractability occurred around pH 7.1 for 238Pu and in the range of pH 4.7 to 5.6 for 242Cm. (Skogerboe-Colorado State)
W79-04236

RESIDUAL FERTILIZER NITROGEN IN A FLOODED RICE SOIL,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
K. R. Reddy, and W. H. Patrick, Jr.
Soil Science Society of America Journal, Vol. 42, No. 2, p 316-318, March-April, 1978. 2 fig, 4 tab, 2 ref.

Descriptors: *Nitrogen, Stable isotopes, Fertilization, *Rice, *Flood irrigation, Incubation, Nutrients.

Residual effects of 15N-labelled fertilizer (ammonium sulfate) nitrogen were measured during the second cropping season of rice (Oryza sativa L.). During the first cropping season, labelled fertilizer N was applied at 100 kg N/ha using different methods of N application. At the end of harvest the rice straw obtained during the first cropping season was incorporated back into the respective plots. During the second season half the plots were treated with an additional 100 kg N/ha of nonlabelled fertilizer N as an early season top dressing. The uptake of residual labelled N was measured during the growing season and at harvest time under fertilized and nonfertilized conditions. The recovery of residual labelled N in grain and straw was 2.7 to 3.1 kg N/ha, with a large fraction of N still remaining in the soil. Approximately 3 to 5 kg of the residual labelled N/ha present at the beginning of the season was not accounted for in any fraction and was assumed to be lost from the system. Over a 2-year period, abour 66 to 82% of the applied labelled fertilizer N could be accounted for by plant uptake or in the soil with the remainder lost from the plant-soil system. (Skogerboe-Colorado State)
W79-04237

SODIUM BICARBONATE EXTRACTION TO ESTIMATE NITROGEN, PHOSPHORUS, AND POTASSIUM AVAILABILITY IN SOILS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Div. of Soil Chemistry and Plant Nutrition.
B. Bar-Yosef, and B. Akiri.
Soil Science Society of America Journal, Vol. 42, No. 2, p 319-323, March-April, 1978. 6 fig, 3 tab, 8 ref, 2 equ.

Descriptors: *Soil analysis, *Soil chemical properties, Soil tests, Nitrogen, *Phosphorus, *Potassium, Calcareous soils, Sodium compounds, Nutrients.

The extractability of NO3-N, P, and K from five calcareous soils differing in physical and chemical characteristics by NaHCO3 (0.5M, pH 8.5) was studied under laboratory conditions. The extracted amounts of the three ions were related to time since their application to the soils, to the equilibration period of the soils with the extractants, to the concentration of the ions in the soils, and to the clay content of the soils. After about 70 days in the soil, the extractability of each ion at a given application level was independent of time. The recovery percentage of P and K as a function of the applied amounts of these elements depended mainly on the clay content of the soils, while NO3-N recovery was independent of the factors studied. Linear relationships were obtained between NaHCO3- and NH4OAC-extracted K, and NaHCO3- and KCl-extracted NO3-N. The slopes for NO3-N were 45 degrees for all soils, but were specific for each soil in the case of K. (Skogerboe-Colorado State)
W79-04238

ARTIFICIAL RECHARGE: PART II,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 4B.
W79-04239

TRITIUM TRACING OF UNSATURATED MOISTURE MOVEMENT,
Clemson Univ., SC. Dept. of Agricultural Engineering.
J. T. Ligon, T. V. Wilson, J. F. Allen, and U. P. Singh.
ASAE Paper No. 75-2015, 1975. Presented at American Society of Agricultural Engineers Annual Meeting, University of California, Davis, June 15-22, 1975. 17 p, 9 fig, 6 ref. OWRT A-023-SC(7).

Descriptors: *Path of pollutants, *Soil moisture, *Tracers, *Watersheds, *Water table, *Soil science, Soil moisture meters, Percolation, Soil tests, Clay, Loam, Sands, Soil investigations, Soil groups, Soil horizons, Soil profiles, Sampling, Soil water movement, Moisture content, Transfer, Soil contamination, Adsorption, Tracking techniques.

Tritium (H-3), a radioactive tracer, was used to define the rate of downward displacement of moisture in the unsaturated portion of a typical Piedmont soil profile in a study to determine the relationship between measured displacement and the displacement predicted from excess root zone moisture and profile moisture content. Tracer experiments were initiated during December 1972 and January 1973 in the Pacolet sand loam on the Clemson (South Carolina) Research Watershed. Daily soil sampling and laboratory counting were started immediately and continued for 693 days. The several conclusions resulting from this study include: (1) the observation of the rate of downward movement of the tagged water inicates that initial contact with the water table about 20 meters deep will occur approximately 5.2 years after placement of the tracer 15 cm deep; (2) maximum activity levels will reach the water table after about 5.7 years; (3) the activity level will be only slightly above background levels when the material reaches the water table due to diffusion and dispersion; (4) very little lateral displacement of the material was observed except for the diffuson and dispersion; and (5) the differential rate of movement through the high clay B-horizon resulting in temporary retention of an area of maximum concentration in one zone and progressively deeper maximum activity in another area may be due to differential adsorption of tritium by clay particles. (Davison-IPA)
W79-04266

IRRIGATION WATER MOVEMENT BELOW THE CORN ROOT ZONE IN CRETE SILT LOAM,
Kansas State Univ., Manhatten. Evapotranspiration Lab.
L. R. Stone, R. J. Raney, E. T. Kanemasu, and W. L. Powers.
Journal of Soil and Water Conservation, Vol. 33, No. 6, p 294-296, November-December 1978. OWRT A-069-KAN(5).

Descriptors: Crete silt loam, *Irrigation schedules, *Water movement, Root zone, Corn.

To better understand the perched water table problem in the Bostwick Irrigation District of Kansas, the extent of water movement below the corn root zone in Crete silt loam (fine, montmorillonitic, mesic, typic, Argiustoll) was evaluated at the Irrigation Experiment Field near Scandia. Little or no water moved through the 150-to 180-centimeter layer durng the study. What water movement took place in this layer was predominantly upward. Maximum upward soil water flux was about 0.02 centimeters per day. Slight water content change and slight water movement in the 150- to 180-centimeter layer indicated little root activity in this zone. In managing this soil one should consider the surface 90 centimeters when determining water reserves available to plants and when planning irrigation schedules. Deep-profile water movement resulting from irrigation did not contribute to the perched water table.
W79-04483

RESPONSES OF SEVERAL FORAGE AND FIELD CROPS TO SUBSURFACE SOIL WARMING AND SEWAGE EFFLUENT SPRAY IRRIGATION,
The Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W79-04489

THE EFFECT OF COMBINED SOIL WARMING AND IRRIGATION ON THE SOIL SURFACE ENERGY BUDGET,
The Pennsylvania State Univ., University Park. Dept. of Meteorology.
D. R. Cook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 282, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, May 1977. 114 p, 27 fig, 9 tab, 7 append, 7 ref. OWRT C-6249(No 5222)(2).

Descriptors: *Soil temperature, Energy budget, Precipitation(Atmospheric), *Evapotranspiration, *Sewage effluents, *Irrigation effects.

Micrometeorological measurements were made on an artificially heated plot of ground and an adjacent control plot to determine differences in the soil surface energy budget. Both plots were irrigated biweekly with secondary treated sewage effluent. Artificial heating effects on the soil surface energy budget are discussed. Estimates of the distribution of artificially introduced energy into latent and sensible heat are given. An evapotranspiration prediction scheme using net radiation, soil surface heat flux density and air vapor pressure deficit as parameters was developed. Measured and predicted evapotranspiration permit the calculation of an annual value. Annual values of net radiation and heat flux density combined with the evapotranspiration yield an annual sensible heat. Evapotranspiration and soil water drainage were measured with non-weighing microlysimeters. Maximum annual irrigation estimates are made for the artificially heated plot from the annual evapotranspiration and drainage rate. The distribution of irrigation and precipitation into evapotranspiration and drainage is discussed. The influence of several micrometeorological conditions on the energy budget is investigated. The applicability of the experimental results to a full scale artificial soil warming system is discussed. (Sink-Penn State)
W79-04490

2H. Lakes

MOVEMENTS OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) IN IMPOUNDED WATERS AS DETERMINED BY UNDERWATER TELEMETRY,
Mississippi State Univ., Mississippi State.
R. L. Warden, Jr., and W. J. Lorio.
Transactions of the American Fisheries Society, Vol. 104, No. 4, p 696-702, October 1975. 2 fig, 2 tab, 6 ref. OWRT A-066-MISS(2).

Descriptors: *Fish behavior, *Largemouth bass, *Impounded waters, Aquatic habitats, Migration, Telemetry, Tagging, Tracking techniques, Water temperature, Diurnal, Nocturnal, Seasonal.

A sonic tracking program was undertaken with the following objectives: (1) to determine the home range of largemouth bass in impounded waters; (2) to determine behavior patterns associated with activity within a home area; and (3) to determine water management practices and environmental parameters resulting in increased or decreased movement. Tags with an average life of 13.8 days were implanted in the body cavity of the fish and appeared to have no effect on the movements of the fish. Sixteen fish were tracked for a total of 570 hours from March 4, 1972 to April 14, 1973. Water temperature was the only parameter related to increases or decreases in movement. Fish were most active in March and September, least active in January and December. Diurnal movement prevailed during the spring and fall, while nocturnal movement increased as the water temperature increased during the summer. Home ranges differed according to water temperature changes, and behavior patterns within them were movements from shallow to deep water. (Davison-IPA)
W79-04016

LIMNOLOGICAL CHARACTERISTICS OF CYPRESS LAKE, UPPER KISSIMMEE RIVER BASIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
N. Gaggiani, and B. F. McPherson.
Geological Survey Water-Resources Investigations 77-45 (open-file report), 1978. 1 sheet, 8 fig, 7 tab, 9 ref.

Descriptors: *Florida, *Lake morphology, *Limnology, *Water quality, *Water levels, Inflow, Discharge(Water), Nutrients, Eutrophication, Dissolved solids, Maps, *Cypress Lake, Upper Kissimmee River basin.

Cypress Lake is in the upper Kissimmee River basin in Florida between Lake Tohopekaliga and Lake Hatchineha. It is remote from urban development and extensive agriculture. Nevertheless, most of the inflow to the lake, about 302,000 acre-ft per year, comes from 2 canals and a creek that drain the upper part of the basin which receives effluent from about 35 percent of the Orlando metropolitan area. With this inflow and a lake volume of 26,100 acre-ft, water in the lake is renewed about every 0.1 year. Cypress Lake has a surface area of 6.4 sq mi, a mean depth of 6.4 ft, an immediate overland drainage area of 29 sq mi and with Lake Hatchineha, receives drainage from 1,162 sq mi. From 1950 to 1964, before locks and dams at the outlets of Lakes Kissimmee and Tohopekaliga regulated water levels at Cypress Lake, water levels fluctuated from 57 ft msl to 48 ft msl, periodically flooding the surrounding area. After regulation from 1964 to 1975, the maximum water level at Cypress Lake was slightly more than 54 ft msl. Specific conductance of the water increased in Cypress Lake from an average of 76 micromho/cm in 1954-65 before regulations to 130 micromho/cm in 1964-75 after regulation. Cypress Lake is classified as a colored alkaline lake with an average color of 79 platinum cobalt units. Emergent marsh vegetation covers almost all the shoreline of the lake. (Woodard-USGS)
W79-04025

WELLS AND PONDS: WATER QUALITY AND SUPPLY,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3C.
W79-04068

THE ECONOMIC IMPACT OF INCREASED FOREST AND FARMLAND BEAVER DAMAGE IN MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Wildlife and Fisheries.
D. H. Arner, and J. S. DuBose.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 991, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, October 1978. 41 p, 5 fig, 9 tab, 8 ref. OWRT A-999-MISS(14).

Descriptors: *Impounded waters, *Ponds, *Damages, Beavers, Mississippi.

A recent inventory of Mississippi beaver ponds indicated 29,128 ha (71,920 ac) of land have been inundated by beaver activity. The average period of impoundment for these inundated lands is nine years. Beaver damage losses were assessed by determining the dollar value of timber, row crop, and beef production precluded on impounded lands. The loss of production on 23,346 ha (57,644 ac) of

timberland, 5,696 ha (14,064 ac) of cropland, and 86 ha (212 ac) of pasture flooded by beaver activity was valued at $22,205,285. This figure represents an average annual loss of $2,467,254 from Mississippi's agricultural economy. Abatement of beaver damage losses is not foreseen in the immediate future.
W79-04074

DYNAMICS OF WAVE-INDUCED CURRENTS IN SEDIMENTS,
Mississippi State Univ. Mississippi State. Dept. of Geology and Geography.
For primary bibliographic entry see Field 2J.
W79-04076

A HYDRAULIC MODEL STUDY OF PROPELLER-TYPE LAKE DESTRATIFICATION PUMPS,
Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
D. K. McLaughlin, and M. R. Givens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 901, Price codes: A04 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, 1978. 62 p, 18 fig, 3 tab, 16 ref, 3 append. OWRT A-075-OKLA(1), 14-34-0001-8038.

Descriptors: *Reaeration, Destratification, Model studies, Hydraulic models, Pumps, *Discharge(Water), *Garton pump.

A hydraulic model study was performed of the local destratification phenomenon using a Garton type propeller prototype and model experiments. Geometrically similar models of a Garton pump were constructed in varying sizes. Experiments were conducted to model the near flowfield of the propeller in the vicinity of a typical dam and release structure. The local destratification experiments involved pumping a jet of surface water down into the heavier bottom water. With the pump located directly over the release inlet structure, the jet from the pump outflow can enhance the quality of water from the release. Successful modeling of the near flowfield of the propeller was achieved. The fundamental modeling parameter is the overall Richardson number. Important initial conditions are pump size ratios and thermocline location. A direct correlation between the nondimensional penetration depth of the jet and the dilution factor of the release samples was established. As the penetration depth of the jet reaches the level of the release intake structure, the dilution factor rapidly increases from zero. Performing experiments with different pump sizes indicates that the largest pump can force top water deeper at the same average axial velocity than the other pumps. The smallest propeller was more effective at improving the quality of water from the release using the same power consumption as the other propellers.
W79-04079

LIFE IN THE GREAT SALT LAKE,
Utah State Univ., Logan. Coll. of Science.
F. J. Post.
Utah Science, Vol. 36, No. 2, p 43-47, June 1975. 3 fig, 2 tab, 1 ref. OWRT-A-024-UTAH (1).

Descriptors: *Saline lakes, *Great Salt Lake, *Biology, Aquatic life, Aquatic environment, Brine shrimp, Bacteria, Aquatic bacteria, Algae, Saline water, Salts, Sodium compounds, Water pollution, Water pollution sources, Water pollution effects.

A study of the biology of the Great Salt Lake north of the railroad causeway is reported. Evaporation losses in the north arm of the lake are compensated for by a flow of water from the south end of the lake, which carries salt and organic matter. The salt level at the north end of the lake has reached the saturation point for sodium chloride, so that this chemical precipitates out on the lake bottom in deposits several feet thick. The few organisms know to live in this harsh environment are: red algae, green algae, brine fly, brine shrimp, halophillic bacteria, and bacterial viruses. Very little is known about the fundamental biology brine systems like the Great Salt Lake. It is a terminal lake at the end of a large watershed where a population of about two million live. All the wastes -- industrial, agricultural and human -- of this population enter the lake as organic matter or chemical elements. The large numbers of bacteria, algae, shrimp, and brine flies indicate that the organic matter is accumulating. Chemical and biological studies are currently being conducted to determine the rates at which the organic materials are cycled within the lake. (Davison-IPA)
W79-04095

FOSSIL PIGMENTS IN MINNESOTA LAKE SEDIMENTS AND THEIR BEARING UPON THE BALANCE BETWEEN TERRESTRIAL AND AQUATIC INPUTS TO SEDIMENTARY ORGANIC MATTER,
E. Gorham, and J. E. Sanger.
Verhandlungen, Internationale Vereinigung for Limnologie, Vol. 19, p 2267-2273, Nov. 1975, 2 tab, 16 ref. Contribution No. 129 from the Limnological Research Center, University of Minnesota. OWRT B-081-MINN(2).

Descriptors: *Pigments, Sediments, *Lakes, Carotenoids, Chlorophyll, Organic matter, Minnesota.

Comparison of pigment concentrations in sedimentary organic matter with those in potential source materials indicates that the major inputs to profundal sedimentary organic matter in Minnesota lakes are aquatic. It seems likely that terrestrial inputs are of considerable importance only in the relatively unproductive northeastern lakes with the lowest concentrations of sedimentary pigments. (Waelti-Minn)
W79-04129

THE PRODUCTION OF MUCILAGE BY DIATOMS IN MCCONAUGHY, PAWNEE AND YANKEE HILL RESERVOIRS AND THE ROLE OF THIS MATERIAL IN THE AQUATIC ENVIRONMENT,
Nebraska Univ., Lincoln. School of Life Sciences.
J. R. Rosowski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 306, Price codes: A04 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska Project Completion Report, January 1979. 50 p, 18 fig, 9 tab, 30 ref. OWRT A-043-NEB(1), 14-34-0001-8029.

Descriptors: *Algae, Bacteria, *Diatoms, Mucilage, Sediments, Water chemistry.

The role of diatom mucilage was examined through a study of algae, water chemistry and physical parameters of three reservoirs in Nebraska--Yankee Hill and Pawnee, small shallow reservoirs, and McConaughy, the largest reservoir in the state. Observations from artificial and natural substrates indicated that diatoms were early invaders and remained the dominant periphytic organisms until they were naturally sloughed off. Diatoms forming mucilaginous stalks dominated the periphyton in the fall of 1976 in McConaughy, in samples 2-4 weeks old; in Pawnee, only by the 4th week; and in Yankee Hill, staled diatoms never dominated the periphyton on plexiglass. Scanning electron microscopy of in situ development indicated that the diatom communities were patchy since unialgal stands of high density developed and remained largely unmixed in the 4-week community. All species of diatoms examined released mucilage from their valve face and mantle, as well as from the girdle region. Distinct forms of bacteria (rods, cocci, caulobacters) were found associated with living diatoms. Diatom mucilages bound suspended particulates, but bacterial extracellular strands are also important in this regard. Considering the conspicuous nature of diatom mucilage in the periphytic community and its association with other algae, bacteria and sediments, mucilage is viewed as having an important but as yet unclear role in the biological and chemical recycling in natural waters.
W79-04310

INTAKE SCREENWELL SURGING CAUSED BY WAVE DYNAMICS,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 8A.
W79-04357

DETERMINATION OF FLOOD LEVELS ON THE PACIFIC NORTHWEST COAST FOR FEDERAL INSURANCE STUDIES,
CH2M/Hill, Redding, CA.
For primary bibliographic entry see Field 2L.
W79-04359

WAVE RUNUP ON IRREGULAR BEACH PROFILES,
MacLaren (James F.) Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 2L.
W79-04362

MINIMIZING WAVE TRANSMISSION THROUGH JETTIED INLETS,
Worcester Polytechnic Inst., Holden, MA. Alden Research Lab.
J. C. Roberge.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 121-129, 1977. 9 fig, 2 tab, 15 ref.

Descriptors: *Inlets(Waterways), *Waves(Water), *Jetties, *Lake Michigan, *Model studies, Hydraulic models, Laboratory tests, Hydraulic structures, Refraction(Waterwaves), Deep water, Shallow water, Shoals, Analysis, *Pigeon Lake(MI), Wave transmission.

Various remedial structure schemes for the reduction of wave transmission through the proposed enlargement of a jettied inlet on Lake Michigan were studied in a 1:65 undistorted scale hydraulic model. Wave induced bank erosion and deposition of suspended material in the inlet channel also were observed, employing moveable bed tracer material. Waves propagating through a parallel jettied inlet can be attenuated effectively by introducing rubble slopes along the sides of the structures. The wave height reduction was demonstrated to be linearly proportional to the length of the rubble section for structures composed of armor units of uniform size and shape. It follows that further attenuation could be achieved by optimizing armor stone characteristics with respect to size, shape, and roughness. The hydraulic model tests described demonstrated that the proposed widening of the Pigeon Lake Inlet would exopose Pigeon Lake to more severe wave action than currently exists. (See also W79-04351) (Humphreys-ISWS)
W79-04363

MODELING DISSOLVED OXYGEN IN THE NEAR-FIELD,
Tulane Univ., New Orleans, LA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04366

GROUNDWATER-SURFACE WATER RELATIONSHIP NEAR LAKE MICHIGAN SHORE,
Illinois State Water Survey, Urbana.
A. P. Visocky.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 195-202, 1977. 4 fig, 3 ref.

Descriptors: *Lake Michigan, *Lake shores, *Groundwater, *Surface waters, *Illinois, Shores, On-site investigations, Water quality, Water levels,

Monitoring, Instrumentation, Flood plains, Precipitation(Atmospheric), Flooding, Barriers, Barrier bars.

Illinois Beach State Park, located along the shores of Lake Michigan 40 miles north of Chicago, is a popular recreational site for the people of northeastern Illinois and southern Wisconsin. High water table levels in vicinity of the park lodge have resulted in basement flooding. Park roadways are often flooded in low sections during heavy storms. Between January 1975 and April 1976, groundwater, stream, and Lake Michigan water level data were collected, as were water samples and precipitation records. The causes of roadway flooding and seepage in the park lodge basement were pinpointed. Certain observations can be made about potential problems in northward park development. Certain observations can be made about potential problems in northward park development. First, surface drainage there should not be the problem it is in the southern half of the park; no extensive marshy areas exist as in the Nature Preserve. Second, the water table is shallow, as in the south, and water free basements will be maintained only by dewatering. The water table problems will be more accute, of course, at any nearshore site. Third, groundwater quality appeared to be a bit better than along Wadsworth Road, but not as good as in the Nature Preserve. (See also W79-04351) (Humphreys-ISWS)
W79-04371

THE STABILITY OF A TWO LAYER FLOW WITHOUT SHEAR IN THE PRESENCE OF BOUNDARY GENERATED TURBULENCE: FIELD VERIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
For primary bibliographic entry see Field 8B.
W79-04372

WISCONSIN'S ENVIRONMENTAL DECADE, INC. V. DEPARTMENT OF NATURAL RESOURCES (CITY POLICY COULD NOT PREVENT CHEMICAL TREATMENT OF STATE WATERS),
271 N.W. 2d 69-79 (Wisc. 1978).

Descriptors: *Chemicals, *Water quality, *Wisconsin, *Aquatic weeds, Navigable waters, Public health, Aquatic weed control, Municipal water, Water resources, Lakes, Algae, Water management.

The defendant Wisconsin Department of Natural Resources (DNR) granted permits for the chemical treatment of aquatic weeds to a small group of riparian property owners. The land owners lived on lakes located in the city of Madison. The City protested the issuance of the permits pursuant to a municipal policy protesting and prohibiting chemical treatment of city lakes. This proceeding was brought to review the order of the state agency. The Wisconsin Supreme Court held that pursuant to state statutes authorizing the DNR to 'supervise chemical treatment' of state waters and the agency's position as trustee of navigable state waters, there was authority to grant permits to chemically control aquatic nuisances despite municipal policy to the contrary. The court further held that the city policy repudiating the practice of chemical treatment of city lakes and the policy of protesting and preventing the use of chemical by others was inconsistent with state statutes. Whatever authority the city could exercise regarding the chemical treatment of noxious weeds on city lakes--waters which had nonlocal impact and were expressly a matter of statewide concern--depended on statutory approval which was absent here. (Hucks-Florida)
W79-04428

2I. Water In Plants

USE OF K/RB RATIO TO CHARACTERIZE POTASSIUM UPTAKE BY PLANT ROOTS GROWING IN SOIL,
Purdue Univ., Lafayette. IN. Dept. of Agronomy.
V. C. Baligar, and S. A. Barber.
Soil Science Society of America Journal, Vol. 42, No. 4, p 575-579, July-August, 1978. 3 fig, 5 tab, 18 ref, 2 equ.

Descriptors: *Potassium, *Root systems, Root development, Moisture uptake, *Ion exchange, Sweet corn, Growth chambers.

Interaction between the plant root and the soil on cation influx into the root is not well understood. Use of the ratio of K/Rb, two ions absorbed interchangeably by the root, enables measurement of the K ion medium influencing K flux into the root. In experiments with corn (Zea mays L.) grown in eight soil-K systems in a growth chamber, the K/Rb ratio of uptake was similar to the K/Rb ratio of the ions on the exchange sites, and not the K/Rb ratio of the solution cations. The data may be interpreted to indicate that K and Rb on the exchange sites had more influence on K and Rb flux into the root than K and Rb in solution. Diffusion of K and Rb from the soil to H-saturated exchange membranes was in the ratio of K/Rb in solution. (Skogerboe-Colorado State)
W79-04206

TRANSPORT OF MICROORGANISMS IN SAND COLUMNS,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
A. G. Wollum, II, and D. K. Cassel.
Soil Science Society of America Journal, Vol. 42, No. 1, p 72-76, January-February, 1978. 6 fig, 5 tab, 8 ref.

Descriptors: Microorganisms, Saturated flow, Wastes, Sewage effluents, *Bacteria.

Transport of streptomycete conidia through saturated columns of uniformly packed sand was studies using miscible displacement techniques. Autoclaved sand was uniformly packed to give sand columns 20.3 and 152 cm high. Mean pore water velocities ranged from 14.4 to 131 cm/hour. A pulse of sterile water containing from 10000 to 1000000 conidia and tagged with 36Cl was displaced through each column with sterile water. Column effluent was collected and analyzed for conidia by serial dilution techniques utilizing starch-casein agar. At the termination of each run, the column was sampled and analyzed for conidia distribution. (Skogerboe-Colorado State).
W79-04211

POTASSIUM AND RUBIDIUM ADSORPTION AND DIFFUSION IN SOIL,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
For primary bibliographic entry see Field 2K.
W79-04216

A NEUTRON ACTIVATION METHOD FOR DETERMINING SUBMICROGRAM SELENIUM IN FORAGE GRASSES,
Missouri Univ.-Columbia. Dept. of Agronomy.
K. A. Cook, and E. R. Graham.
Soil Science Society of America Journal, Vol. 42, No. 1, p 57-60, January-February, 1978. 1 fig, 5 tab, 7 ref.

Descriptors: Fescues, *Forage grasses, *Neutron activation analysis, Radiochemical analysis, Irradiation.

Neutron activation as a method for the analysis of submicrogram amounts of Se in fescue and orchard leaves was evaluated. It was observed that the Se content of National Bureau of Standard orchard leaves was 0.078 ppm compared with the NBS reported value of 0.080 ppm Se. The relative standard deviation for the orchard leaves was found to be 5.3%. Following irradiation and nitric-perchloric acid digestion, Se was extracted from a 4M HBr solution using benzene containing 1% phenol. The method is sufficiently sensitive to measure with accuracy 0.010 ppm Se in 0.250 g of material. The method is straightforward and accurate and requires the extraction of Se benzene which is completely free of phosphorus. (Skogerboe-Colorado State)
W79-04235

A TECHNIQUE FOR ASSESSING SEEDLING EMERGENCE UNDER DROUGHT STRESS,
Utah Agricultural Experiment Station, Logan.
For primary bibliographic entry see Field 3F.
W79-04280

WATER UPTAKE BY PLANTS: I. DIVIDED ROOT EXPERIMENTS,
Geological Survey Menlo Park, CA. Water Resources Div.
W. N. Herkelrath, E. E. Miller, and W. R. Gardner.
Soil Science Society of America Journal, Vol. 41, No. 6, p 1033-1038, November-December, 1977. 13 fig, 22 ref, 5 equ.

Descriptors: *Soil water, Soil moisture, *Root systems, Root zone, Root development, Crop production.

The influence of soil water content and soil water potential upon root water uptake was investigated in a controlled laboratory environment. Water extraction rates by roots of winter wheat were measured in situ in a soil column instrumented with a gamma-ray attenuation water-content meter, tensiometers, and physchrometers. In addition, the leaf water potential was measured with an in situ leaf hygrometer. In order to measure the vertical distribution of water uptake, the column was divided into five sections by wax layers which were penetrated by roots, but which prevented movement of water between sections in the soil. (See also W79-04349)(Skogerboe-Colorado State)
W79-04348

WATER UPTAKE BY PLANTS: II. THE ROOT CONTACT MODEL,
Geological Survey, Menlo Park, CA. Water Resources Div.
W. N. Herkelrath, E. E. Miller, and W. R. Gardner.
Soil Science Society of America Journal, Vol. 41, No. 6, p 1039-1042, November-December, 1977. 7 fig, 1 tab, 6 ref.

Descriptors: Model studies, Root development, *Root systems, *Soil water, Soil moisture, Simulaton analysis.

In the standard analysis of root water uptake, it is assumed there is a constant root membrane resistance in series with a soil resistance which is dependent upon the soil moisture diffusivity. The relation of root extraction rate to soil water content and to soil water potential predicted by this standard model was compared to the results of divided root experiments. The extraction rates predicted by the theory were as much as eight times larger than the measured values. A reasonable fit between theory and experment could only be obtained by assuming in the theoretical calculations that the rooting density was 100 times smaller than that measured in the experiments. (See also W79-04348)(Skogerboe-Colorado State)
W79-04349

SEASONAL PATTERNS OF NUTRIENT MOVEMENT IN A FRESHWATER TIDAL MARSH,
Rider Coll., Trenton, NJ. Dept. of Biology.
R. L. Simpson, D. F. Whigham, and R. Walker.
In: Freshwater Wetlands: Ecological Processes and Management Potential, by Good, R.E., Whigham, D.F., and Simpson, R.L. p 244-257, 9 fig, 12 ref, 1978. Academic Press, N.Y. OWRT B-060-NJ(2), 14-34-0001-6099.

Descriptors: *Freshwater marsh, *Nutrients, Organic matter, Carbon dioxide, Dissolved oxygen, New Jersey, Nitrogen, Tidal effects, Decomposition, Algae.

The distribution and movement of dissolved O2, CO2, NO3-N and PO4-P in the surface waters of a freshwater tidal marsh were studied. Tidal action, particularly periodic inundation and flushing, resulted in distinctly different patterns of nutrient distribution in the major wetland habitats. Inorganic N and PO4-P were accumulated in the marsh during summer with emergent vegetation appearing to play an important role in the uptake and retention of nutrients. Although evidence is accumulating that some N and P may be translocated into belowground parts by several perennial macrophytes, most is rapidly leached after death of vascular plants with up to 80% of the total N and even more of the P lost within 1 month. In pond-like areas where filamentous algal blooms develop following the fall dieback of vascular plants, inorganic N and PO4-P levels remain depressed through the winter and spring. On the basis of available evidence, it appears almost all habitats of freshwater tidal marshes may be sinks for inorganic N and PO4-P during the vascular plant growing season and that certain habitats may continually function as sinks.
W79-04484

BIOMASS AND PRIMARY PRODUCTION IN FRESHWATER TIDAL WETLANDS OF THE MIDDLE ATLANTIC COAST,
Rider Coll., Trenton, NJ. Dept. of Biology.
D. F. Whigham, J. McCormick, R. E. Good, and R. L. Simpson.
In: Freshwater Wetlands: Ecological Processes and Management Potential, by Good, R.E., Whigham, D.F. and Simpson, D.F. p 3-20, 2 fig, 4 tab, 39 ref, 1978. Academic Press, NY. OWRT B-060-NJ(3), 14-34-0001-6099.

Descriptors: *Primary production, *Biomass, *Wetlands, *Freshwater marshes, Tidal waters.

Although there are many measurements of peak standing crop and several estimates of aboveground annual net production, there are few accurate estimates of total net primary production for Middle Atlantic coastal freshwater tidal wetlands. Estimates of biomass and production vary widely both within and between vegetation types. The variability appears to be due to sampling techniques and/or the heterogeneous nature of freshwater tidal wetland vegetation. Undoubtedly, all estimates of primary production are low because they do not include data on growing season mortality of plants and plant parts, herbivore consumption, and belowground production. Most estimates of primary production are also low because freshwater tidal wetland communities usually undergo a series of physiognomic changes during the growing season and the measurements of primary production do not account for those seasonal patterns. Comparatively, freshwater macrophyte production in tidal wetlands appears to be at least equal to that of brackish water wetlands at the same geographic latitude.
W79-04485

NITROGEN INPUTS TO STREAM WATER FROM FORESTS ALONG AN ELEVATIONAL GRADIENT IN NEW MEXICO,
New Mexico Univ., Albuquerque. Dept. of Biology.
J. R. Gosz.
Water Research, Vol 12, No. 9. p 725-734, 1978. 7 fig, 7 tab, 23 ref. OWRT-B-053-NMEX(3), 14-31-0001-50-95.

Descriptors: *Nitrogen, *Forests, *Runoff, Nutrients, Nitrogen compounds, Trees, Vegetation, Surveys, On-site investigations, Streams, Watersheds(Basins), Forest watersheds, Denitrification.

Studies of nitrogen inputs in precipitation and outputs in stream water for a number of terrestrial ecosystems supported the hypothesis that undisturbed communities leave the ability to reduce losses of nitrogen via stream water. In spite of different levels of biomass, productivity, and stream discharge for these communities, net losses of nitrogen were similar. Maintaining nitrogen in an organic or cation form (NH3, NH4 (+)) is an important factor in minimizing loss. This may be accomplished by slow rates of mineralization, rapid plant uptake, and denitrification through the electron sink pathway. Denitrification by the dissimilatory pathway also may be important. (Sims-ISWS)
W79-04498

2J. Erosion and Sedimentation

TRACE METAL RELATIONSHIPS IN BOTTOM SEDIMENTS OF A FRESH WATER STREAM--THE BUFFALO RIVER, ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Geology.
K. F. Steele, and G. H. Wagner.
Journal of Sedimentary Petrology, Vol. 45, No. 1, p 310-319, March 1975. 5 fig, 4 tab, 8 ref. OWRT A-025-ARK(2).

Descriptors: *Rivers, *Buffalo River, *Arkansas, *Trace elements, *Sediments, Bottom sediments, Sediment transport, Analytical techniques, Metals, Sediment load, Movement, Sedimentary rocks, Dolomite, Chert, Downstream, Upstream, Drainage area, Sampling.

A total of 77 sediment samples were taken from the lower 130 miles of the Buffalo River in Arkansas to chemically assess the present state of the river. The samples were acid extracted with aqua regia and analyzed by atomic absorption for Na, K, Mg, Ca, Fe, Mn, Ni, Cr, Cu, Cb, Cd, Co, Pb, and Zn. The elements Na, K, Mg, and Ca are related to the geology of the area; the remainder are potential pollutants, some of which are related to the area's mineralogy. Sixteen samples were dissolved by hydrofluoric acid techniques and analyzed by atomic absorption. A comparison of the trace elements thus obtained with the amounts obtained by aqua regia extraction showed that with the exceptions of sodium and potassium, aqua regia gave a high percentage of the total of each metal present. The downstream area showed a general decrease in Fe, Cu, Cr, Ni, Mn, Pb, K, and Na as the drainage area increased in carbonate rock and decreased in shale. Downstream sediments increased in Mg, Ca, Zn, and Cd. The sediments, quartz and chert grains, are coated with hydrous iron oxide which acts as a sorbent for most of the metals, and is a transport mechanism for acid extractable Co, Cr, Ni, Cu, Mn, and K. The other acid extractable metals are mostly in clastic grains. The acid extractable amounts of the drainage area ore metals, Zn, Pb, and Cu, in the sediments rise and fall with the extractable amounts of Ca plus Mg in the sediments indicating the presence of dolomite. (Davison-IPA)
W79-04017

EROSION, SEDIMENT DISCHARGE, AND CHANNEL MORPHOLOGY IN THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.; and Geological Survey, Doraville, GA. Land Information Analysis.
R. E. Faye, W. P. Carey, J. K. Stamer, and R. L. Kleckner.
Geological Survey open-file report 78-576, 1978. 133 p, 46 fig, 31 tab, 41 ref.

Descriptors: *Georgia, *Sediment transport, *Sediment yield, *Suspended solids, *Erosion, Land use, Urbanization, *Agricultural runoff, Trace elements, Streamflow, Channel morphology, Turbidity, Nutrients, Geomorphology, Regulated flow, Streamflow-runoff relationships, Topography, *Upper Chattahoochee River basin.

Average annual rates of sheet erosion and sediment discharge were computed for several watersheds in the Upper Chattahoochee River basin in Georgia. Erosion yields ranged from about 900 to 6,000 tons per year per square mile in nine watersheds and were greatest where land use is largely agricultural or transitional. Suspended sediment yields from the same watershed ranged from about 300 to 800 tons per year per square mile and were greatest from urban areas and least from mostly forested watersheds. The impact of suspended sediment on stream quality was evaluated for 14 watersheds. In general, 60 percent or more of the total annual discharge of trace metals and phosphorus was contributed by suspended sediment. Yields of trace metals and nutrients in suspension were consistently greater in urban watersheds. Turbidity in basin streams increased geometrically with increasing concentrations of suspended sediment. (Woodard-USGS)
W79-04029

DREDGED MATERIAL RESEARCH PROGRAM, FOURTH ANNUAL REPORT.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 6G.
W79-04044

DYNAMICS OF WAVE-INDUCED CURRENTS IN SEDIMENTS,
Mississippi State Univ. Mississippi State. Dept. of Geology and Geography.
D. M. Keady.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 990, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, October 1978. 23 p, 3 fig, 1 tab, 15 ref. OWRT A-999-MISS(13).

Descriptors: *Waves, *Bottom sediments, *Beds under water, Percolation, Darcys law, Water flow, Ripple marks.

The study involved observation of water motion induced by waves within sediments. Five sizes of sediments--small pebbles, granules, very coarse sand, coarse sand, and medium sand--were placed in a wave tank in such a manner that observations could be made in each segment as waves of similar characteristics passed over them. Dyes and near-neutral buoyant balls confined in channels were used to study the motion of the water. Pressure intensities were measured at the sediment-water interface at a fixed depth within each segment. Water movement in the three larger size sediments was readily observable and relative measures of the magnitude of the movements were obtained; water movement in the two smaller size sediments was negligible. The results of the laboratory studies and results from previous investigations indicate that the choice of theory to solve practical problems should be based on careful consideration of the magnitude of permeability, the compressibility of water, and the compressibility and cohesiveness of the grain skeleton.
W79-04076

FLOODING AND SEDIMENT TRANSPORT IN A SMALL ALPINE DRAINAGE BASIN IN COLORADO,
A. I. Mears.
Geology, Vol. 7, No. 1, p 53-57, January 1979. 3 fig, 2 tab, 10 ref.

Descriptors: *Small watersheds, *Floods, *Sediment transport, *Colorado, Watersheds(Basins), Alpine, Runoff, Boulders, Movement, Particle size, Bed load, On-site investigations, Analytical techniques, Mannings equation, Rational formula, Analysis, Floods.

A short-duration, high-intensity rainfall on a 0.43 sq km alpine drainage basin in the central Colorado mountains produced a peak discharge, including water and sediment, of 108 to 134 cu m/s. This exceeds by an order of magnitude the discharge of the 100-yr flood as predicted by the procedures recommended by the Soil Conservation Service and exceeds by a factor of two the largest discharge ever reported in a basin of similar size. The Manning formula and superelevation calculations were two methods used to compute velocities and discharges. These two methods depend upon independent sets of assumptions, but they produced similar results. Calculations of the fluid-dynamic stresses required to transport boulders in the upper channel also suggest flood formula and superelevа-

tion calculations. In the lower channel, bed load moved as inertial grain flows. One flow studied in detail transported sediment onto a part of the alluvial fan not reached by deep flood water. The larger clasts were transported to the top and front of the grain flow. This type of sorting supports a theory of grain-flow deformation first suggested by Bagnold. Gran flows advancing at the velocities calculated in this paper can be potentially damaging to buildings located in their paths. (Humphreys-ISWS)
W79-04090

A LARGE-VOLUME INTERSTITIAL WATER SEDIMENT SQUEEZER FOR LAKE SEDIMENTS,
Maine Univ. at Orono. Dept. of Geological Sciences.
D. R. Sasseville, A. P. Takacs, S. A. Norton, and R. B. Davis.
Limnology and Oceanography, Vol. 19, No. 6, p 1001-1004, November 1974. 2 fig, 7 ref. OWRT-A-026-ME (4).

Descriptors: *Lake sediments, *Limnology, *Sediment yield, *Laboratory equipment, Costs, Filtration, Filters, Sieve analysis, Sampling, Water sampling, Bottom sampling, Separation techniques, Water quality.

A light weight, highly portable 800-CC interstitial water sediment squeezer which can process 75 ml/200 cc of sediment in 15 minutes is described. The sample does not come in contact with any metal, because all surfaces are Teflon coated. Because many parts are hardware stock and machining time is minimal, the cost is low. Detailed diagrams are provided. (Davison-IPA)
W79-04098

SUSPENDED SOLIDS CARRIED BY THE GALLATIN RIVER OF SOUTHWESTERN MONTANA: II. USING MINERALOGY FOR INFERRING SOURCES,
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
M. G. Klages, and Y. P. Hsieh.
Journal of Environmental Quality, Vol. 4, No. 1, p 68-73, January-March, 1975. 3 fig, 3 tab, 12 ref. OWRT A-041-MONT(3).

Descriptors: *Suspended solids, *Gallating River(Montana), *Sediment transport, *Mineralogy, Silts, Clay, Quartz, Alluvium, Erosion, X-ray diffraction, Geology, Sampling, Deposition(Sediments), River basins, Watersheds(Basins), Tributaries.

Suspended sediment samples were taken from the Gallatin River and its tributaries from March to June in 1970 and 1971. Samples were taken from the lower valley after a snow or a rainstorm during March and April. The entire river system was sampled at two-week intervals during May and June regardless of precipitation. The silt and clay carried in suspension were examined by X-ray diffraction. The mineralogy of these suspended solids is related to geology of the eroding area. The variation in suspended sediments of the individual tributaries allowed the mineralogy to be used to infer the main source. Quartz yielded dominant diffraction peak in silts and smectic in clays. Taylor Fork, a tributary, was identified as the major source of suspended solids. The mineralogy of the silt and clay of this tributary resembled that carried by the river on 8 to 10 sampling dates. Alluvial materials eroded from the lower valley produced sediment with mineralogy similar to that presently carried by the river indicating that sediment sources have not changed much during recent geologic time. (See also W75-04501)(Davison-IPA)
W79-04099

UNIT SEDIMENT GRAPH,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
O. Rendon-Herrero.
Water Resources Research, Vol. 14, No. 5, p 889-901, October 1978. 12 fig, 3 tab, 23 ref.

Descriptors: *Unit hydrographs, *Watersheds(Basins), *Pennsylvania, Suspended sediment, Sediment transport, Sediment yield, Suspended load, Hydrographs, Hydrology, Graphical analysis, *Bixler Run(PA), *Sediment graph, Unit sediment graph.

The unit hydrograph method was extended to sediment graph analysis, thus yielding a unit sediment graph. The method is applicable to small uniform watersheds where the main contribution to suspended sediment transported in the drainage channels as the result of runoff derives from upslope erosion, that is, from wash load and not from entrained bed load material. Bixler Run, a small wash load-producing watershed near Loysville, Pennsylvania, was used as a data source in deriving unit sediment graphs. The hydrographs and concomitant sediment graphs used are generally parallel in shape and coincide during peak flow. (Lee-ISWS)
W79-04172

SUSPENDED SOLIDS IN WATER.
For primary bibliographic entry see Field 2L.
W79-04258

STUDY OF SEDIMENT GENERATION, TRANSPORT AND DEPOSITION IN SEMIARID ZONES,
Hebrew Univ., Jerusalem, Israel.
A. P. Schick.
Hydrological Sciences Bulletin, Vol. 22, No. 4, p. 535-542, Dec., 1977. 12 ref.

Descriptors: *Sediment control, *Sediment load, *Sediment distribution, *Sediment transport, *Sediment discharge, Channel erosion, Soil conservation, Silting, Silts, Erosion rates, Denudation, Stream erosion, Land management, Erosion control, Soil management, Water control, Arid lands, Reviews.

Sediment generation, transport and deposition in arid and semiarid regions of the world are problems complicated by the extremely variable precipitation and runoff characteristics of these areas. Additionally, the fragile environmental balance between erosion and conservation in arid regions is often upset by changes in climate, land use or technological impact. With the purpose of illustrating these problems and their potential solutions, this author presents a group of individual summaries by way of a general analysis, covering: (1) sediment transport in the Nile, (2) suspended load in the rivers of Northern Peru, (3) stream discharge, suspended sediment and erosion rates in the Red Deer River Basin of Alberta, Canada, (4) silting rates of reservoirs in Tunisia, (5) erosion from micro-catchments in the Sahel, and (6) erosion survey and evaluation of the Oued El-Hadjel Basin in Tunisia. The diversity and complexity of the problems discussed is apparent from the widely varying data reported on the concentration of suspended sediment (from 100 to 100,000 ppm) and on, mean annual denudation (from 10 to nearly 10,000 t km). It is this author's belief that past preoccupations with erosion rates should be replaced with a more comprehensive approach toward answering the questions of 'where from', 'where to', and 'how often'. (Tickes-Arizona)
W79-04301

SEDIMENTATION RATES IN LAKE CHAMPLAIN SINCE SETTLEMENT BY MAN,
Vermont Univ., Burlington. Dept. of Geology.
S. Hunt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 305, Price codes: A03 in paper copy, A01 in microfiche. Vermont Water Resources Research Center, University of Vermont Technical Completion Report, 1979. 24 p, 1 fig, 3 tab, 28 ref. OWRT A-033-VT(1).

Descriptors: *Sedimentation rates, *Lake Champlain, Ambrosia, Pollen dating.

Post-settlement sedimentation rates have been measured in twelve cores from Malletts Bay, eastern Lake Champlain, using pollen and diatom stratigraphy. A marked increase in Ambrosia pollen was observed in all cores studied. The data suggest deep water depositional rates in outer Malletts Bay of between .3 to 3 mm/yr. Sediment input into Malletts Bay is on the order of 28,800 metric tons a year which represents a denudation of 16 metric tons per square kilometer a year in the drainage basin. Study of two cores from central Lake Champlain revealed sedimentation rates of .6 mm/year and indicates the dating methods have widespread application.
W79-04308

HYDRAULICS IN THE COASTAL ZONE.
For primary bibliographic entry see Field 2L.
W79-04351

GROUNDWATER-SURFACE WATER RELATIONSHIP NEAR LAKE MICHIGAN SHORE,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W79-04371

VELOCITY DISTRIBUTION AND SEDIMENT MOTION INDUCED BY SHIP'S PROPELLER IN SHIP CHANNELS,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-04374

EXPERIMENTAL STUDIES OF BEACH SCOUR DUE TO WAVE ACTION,
Korean Ocean and Research Development Inst., Seoul (South Korea).
For primary bibliographic entry see Field 2L.
W79-04386

TRANSPORTATION OF ORGANIC DETRITUS IN ESTUARIES,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2L.
W79-04388

CHANNEL EROSION SURVEYS ALONG THE TAPS ROUTE, ALASKA 1977,
Geological Survey, Anchorage, AK. Water Resources Div.
R. M. Loeffler, and J. M. Childers.
Geological Survey open-file report 78-611 (basic data), 1977. 88 p, 49 fig, 9 ref.

Descriptors: *Channel erosion, *Alaska, *Pipelines, *Photogrammetry, *Remote sensing, Data collections, Scour, Construction, Bank erosion, Streamflow, Flood plains, Melt water, Streambeds, Erosion, Evaluation, *Trans-Alaska pipeline system(TAPS).

Channel surveys were made along the trans-Alaska pipeline system (TAPS) route during 1977 at the same 28 sites that were studied in 1976. In addition, a new site at pipeline mile 22 near Deadhorse (alignment No 134) along the Sagavanirktok River was put under surveillance. Except for changes wrought by the completion of construction, most of the sites showed very little change. Significant events include virtual completion of all construction activities along the pipeline, the pipeline startup, and the breakup flood along the Sagavanirktok River which breached many river-training structures. In general, 1977 saw heavy flooding on streams draining the north and south slopes of the Brooks Range and only moderate flooding on streams further south. Aerial photogrammetric surveys were used again in 1977 on the same seven sites as in 1976. Results document the applicability of the method for channel erosion studies. (Woodard-USGS)
W79-04411

STATE V. BEACH COMPANY (SPORADIC, RECREATION USE OF PRIVATE BEACH-FRONT LAND NOT SUFFICIENT TO CREATE PUBLIC EASEMENT TO BEACH).
248 S. E. 2d 115-20 (S.C. 1978).

Descriptors: *Prescriptive rights, *South Carolina, *Public access, *Beaches, Easements, Oceans, Islands, State jurisdiction, Properties, Construction, Accretion(Legal aspects), Land development.

The state of South Carolina brought an action against the corporate owners of island property, alleging that certain rights of the public to use a beachfront area on the island had been intruded upon by the defendants. The state sought to enjoin the development of the property. The trial court determined that there had been a dedication of a certain portion of the property to the public by way of continued public use. However, on appeal, the South Carolina Supreme Court held that the general public did not acquire a permanent easement or prescriptive right of use that could operate to effectively prohibit the sale or development of the property by the owner of the fee simple title where no dedication could be proven by plat or other written instrument. Further, no dedication could be implied from the permissive, sporadic and recreational use which had occurred here. The court also stated that where the land owned by defendants had been subjected to accretion by natural alluvial action, then the owner's title extended to the increased land resulting from the accretion. (Hucks-Florida)
W79-04429

DRAWING THE LINE AT THE OCEANFRONT: THE ROLE OF COASTAL CONSTRUCTION SETBACK LINES IN REGULATING DEVELOPMENT OF THE COASTAL ZONE,
Spessard L. Holland Law Center, Gainesville, FL.
F. E. Maloney, and A. J. O'Donnell, Jr.
Univ. of Fla. Law Review, Vol. 30, No. 2, p 383-418, Winter 1978.

Descriptors: *Beaches, *Florida, *Construction, *Environmental control, Permits, Coastal engineering, Environmental effects, Beach erosion, Regulation, Water pollution, Land development.

In recent years there has been a marked increase in real estate development. This rapid and largely unrestrained growth has resulted in increased public awareness and concern over potential environmental impact. Public concern is especially keen in Florida where coastal lands are of crucial economic importance to the state. The state legislature and state administrative agencies have attempted to enact measures to regulate developments of regional impact, protect ecologically critical areas and promote comprehensive and environmentally sound land use planning throughout the state. One popular method of regulating coastal development, the use of construction setback lines, is examined here in detail. Setback lines establish a strip of land next to the water on which no construction is permitted. Setback lines have been used by both the state and local communities as a means of protecting and preserving the coastline. A model ordinance, which utilizes setback lines and construction permits to minimize the adverse environmental impact of coastal development, is offered. The background of similar ordinances in Florida is examined. (Hucks-Florida)
W79-04432

STATE LAW, NOT FEDERAL, DETERMINES RIPARIAN RIGHTS TO ACCRETIONS,
For primary bibliographic entry see Field 6E.
W79-04450

2K. Chemical Processes

THE COMPLEXING AND ADSORPTION OF CADMIUM IN SOILS IN THE PRESENCE OF EDTA AND NTA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W79-04007

CONTENTS OF SOME HEAVY METALS IN NORWEGIAN RIVERS,
Institutt for Atomenergi, Kjeller (Norway). Isotope Labs.
For primary bibliographic entry see Field 5A.
W79-04021

A STUDY OF LOUISIANA'S MAJOR ESTUARIES AND ADJACENT OFFSHORE WATERS,
Louisiana Wildlife and Fisheries Commission, New Orleans.
For primary bibliographic entry see Field 2L.
W79-04156

GREENHOUSE EVALUATION OF RESIDUAL PHOSPHATE BY FOUR PHOSPHORUS METHODS IN NEUTRAL AND CALCAREOUS SOILS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
R. A. Bowman, S. R. Olsen, and F. S. Watanabe.
Soil Science Society of America Journal, Vol. 42, No. 3, p 451-454, May-June, 1978. 3 fig, 3 tab, 32 ref, 2 equ.

Descriptors: *Phosphorus, Chemical analysis, *Soil chemical properties, Calcareous soils, Carriers, Greenhouses.

Four determinations of phosphorus--Olsen-P, Colwell-P, total exchangeable P, and resin-extractable P--were evaluated in terms of total plant P uptake in a 3-year continuous greenhouse study of 23 high P calcareous and neutral soils. All methods were highly correlated with total P taken up from the soils by 5-8 successive greenhouse crops. The Olsen-P procedure extracted an average of nearly 50% of the total plant P while the Colwell procedure extracted nearly 80%. Resin-extractable P and total exhangeable P values approximated the total plant P uptake, and served as good biological measures of the total plant-available P in the soil. No significant differences were observed between the carrier and carrier-free 32P methods on the 23 test soils. (Skogerboe-Colorado State)
W79-04178

DEVELOPMENT OF A DTPA SOIL TEST FOR ZINC, IRON, MANGANESE, AND COPPER,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
W. L. Lindsay, and W. A. Norvell.
Soil Science Society of America Journal, Vol. 42, No. 3, p 421-428, May-June 1978. 4 fig, 7 tab, 31 ref.

Descriptors: *Chelation, *Soil tests, *Spectrophometry, Nutrients, Fertilizers, Sweet corn, Sorghum, Colorado, DTPA test, Zinc, Iron, Manganese, Copper.

A DTPA soil test was developed to identity near-neutral and calcareous soils with insufficient available Zn, Fe, Mn, or Cu for maximum yields of crops. The extractant consists of 0.005M DTPA, 0.1M triethanolamine, and 0.01M CaC12, with a pH of 7.3 The soil test successfully separated 77 Colorado soils on the basis of crop response to Zn, Fe, and Mn fertilizers. Development of the soil test was based, in part, on theoretical considerations. The extractant is buffered at pH 7.30 and contains CaC12 so that equilibrium with CaC03 is established at a C02 level about 10 times that of the atmosphere. Thus, the extractant precludes dissolution of CaC03 and the release of occluded nutrients which are normally not available to plants. DTPA was selected as the chelating agent because it can effectively extract all four micronutrient metals. Factors such as pH, concentration of chelating agent, time of shaking, and temperature of extraction affect the amount of micronutrients extracted and were adjusted for maximum overall effectiveness. (Skogerboe-Colorado State)
W79-04179

EFFECTS OF SOLUTION CHEMISTRY AND ENVIRONMENTAL CONDITIONS ON AMMONIA VOLATILIZATION LOSSES FROM AQUEOUS SYSTEMS,
International Fertilizer Development Center, Florence, AL. Agro-Economic Div.
P. L. G. Vlek, and J. M. Stumpe.
Soil Science Society of America Journal, Vol. 42, No. 3, p. 416-421, May-June, 1978. 5 fig, 1 tab, 17 ref, 7 equ.

Descriptors: Nitrogen, *Ammonia, Volatility, Rice, Fertilizers, Aqueous solutions, Kinetics.

Laboratory studies were conducted to explain the wide variation in reported estimates of ammonia volatilization losses from N-fertilized paddy fields. The ammonia volatilization capacity of a system was found to be equivalent to its alkalinity. In solutions lacking alkalinity, loss of (NH4)2SO4 was limited, whereas loss of (NH4)2CO3 was essentially complete. Ammonia loss from solution is best described as a consecutive reaction with opposing step. Ammonia volatilization per se followed first-order reaction kinetics. The rate of ammonia volatilization is thus directly related to the concentration of aqueous ammonia and therefore to the concentration of ammoniacal N and pH. The rate of ammonia volatilization was severely restricted by limiting the movement of air above the water, as is often the case in the laboratory and field studies reported to date. Ammonia volatilization was enhanced by water turbulence and increased exponentially with temperature from almost nil at O C to approximately 20 mg N/100 sq cm/5 hours at 46C. (Skogerboe-Colorado State)
W79-04180

SURFACE CHARGE MANIPULATION OF CONSTANT SURFACE POTENTIAL SOIL COLLOIDS: I. RELATION TO SORBED PHOSPHORUS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
S. S. Wann, and G. Uehara.
Soil Science Society of America Journal, Vol. 42, No. 4, p. 565-570, July-August, 1978. 7 fig, 4 tab, 20 ref, 7 equ.

Descriptors: *Colloids, Phosphorus, *Cation adsorption, Cation exchange, Soil management, *Soil chemistry.

A significant correlation was found between the zero point of charge and the quantity of phosphorus applied to soil material from an Oxisol. Sorbed phosphorus lowered the zero point of charge and increased surface charge density at any pH above the zero point of charge. The soil was treated with 0, 100, 500, and 1,500 ppm P as (NH4)2HPO4. For the soil with no added phosphorus, low concentration of monovalent electrolyte and within two pH units of the zero point of charge, diffuse layer theory adequately predicted surface charge. For high electrolyte concentration and high pH, the Stern theory with specific adsorption energy predicted the experimental results. The calculated results indicated charge reversal in the high-phosphorus samples. (Skogerboe-Colorado State)
W79-04203

FACTORS AFFECTING DENITRIFICATION IN A SONORAN DESERT SOIL,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
R. L. Westerman, and T. C. Tucker.
Soil Science Society of America Journal, Vol. 42, No. 4, p. 596-599, July-August, 1978. 4 fig, 3 tab, 6 ref.

Descriptors: *Denitrification, Nitrogen, Temperature, Moisture content, Time, Arid climates, *Deserts, Carbon, Depth.

Incubation studies were conducted to determine the effect of temperature, moisture content, organic C, soil depth, and time on transformations of added 15NO3(-N) to a Sonoran Desert soil in open and closed systems. In open system studies, increasing temperature from 20 to 37C, adding or-

anic C, and increasing moisture content from field apacity to saturation increased denitrification osses 16, 22, and 2%, respectively. There were no pparent differences in immobilization of 15NO3(-) due to temperature, time, moisture content, or oil depth without organic C amendments. Howev- r, immobilization of 15NO3(-N) soils with organic amendments was increased markedly with in- reased temperature and time, but initial moisture ontent had little effect. At C/N ratios of 150:1 nly traces of 15N appeared in NH4(-N), however, t C/N ratios of 15:1 to 45:1 ammonification and nmobilization occurred simultaneously. Closed ystem investigation with organic C and 15NO3(-) amendments showed 79% loss in 5 days with ne remaining 21% accumulating as organic-15N. Denitrification losses in open systems with soil noisture contents representative of saturated con- itions were 70% of the loss observed under closed ystems at the same moisture content. (Skogerboe-Colorado State)
W79-04204

PHOSPHATE DESORPTION FROM KAOLIN- TE SUSPENSIONS,
Volcani Inst. fo Agricultural Research, Bet-Dagan (Israel). Div. of Soil Chemistry and Plant Nutri- on.
. Bar-Yosef, and U. Kafkafi.
oil Science Society of America Journal, Vol. 42, No. 4, p 570-574, July-August, 1978. 5 fig, 2 tab, 18 ef, 2 equ.

Descriptors: *Phosphates, *Kaolinite, Activation nergy, Hysteresis.

The objective of this work was to study the effect f the desorption method used, equilibration time nd the dissolved silica on the desorption of P rom kaolinite. Two desorption methods were sed: (1) diluting 1% suspensions by various vol- mes of the same electrolyte, and (2) immersing a ialysis tube containing 0.25% suspension(+P) in n identical suspension initially free of P. The esorption process in both cases could be divided nto a rapid and a slow first-order reaction. The apid reaction rate constant was similar in both ystems (about 4.5 x 0.001/hour at 25C). The slow eaction constants were 0.3 x 0.001/hour and 1.15 0.001/hour for cases (1) and (2), respectively. The activation energy of the desorption process in ase (2) was 16.2 Kcal/mole for the rapid and 4.8 Kcal/mole for the slow reaction. The amount of ilica dissolved from kaolinite due to dilution with .01M KCl depended on the dilution ratio and eached 16 mg SiO2/g kaolinite when the suspen- ion was diluted 100-fold. Readsorption of part of he dissolved silica is stipulated to contribute to the ast P desorption process. (Skogerboe-Colorado tate)
W79-04207

PREDICTION OF PHOSPHORUS DIFFUSION FROM FERTILIZER SOURCE,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
G. S. Hira, and N. T. Singh.
Soil Science Society of America Journal, Vol. 42, No. 4, p 561-565, July-August, 1978. 7 fig, 2 tab, 11 ef, 11 equ.

Descriptors: *Phosphorus, Diffusion, Fertilizers, Adsorption, Isotherms, *Soil chemistry.

Rate of P diffusion from fertilizer applied at the oil surface was studied using Fick's law of diffu- ion. The diffusion coefficient of P was determined rom a knowledge of the tortuosity factor and P dsorption isotherm. Phosphorus diffusion coeffi- ient calculated from Nye's equation did not prove uitable at very low or high concentration of P at he soil surface. The phosphorus diffusion coeffi- ient calculated from experimental data increased nearly with the square root of P concentration pplied at the source. Predicted P concentration- istance profiles were very close to the experimen- al values estimated by employing a sectioning echnique. (Skogerboe-Colorado State)
W79-04208

THERMODYNAMICS OF POTASSIUM-CAL- CIUM AND MAGNESIUM-CALCIUM EX- CHANGE REACTIONS ON A KAOLINITIC SOIL CLAY,
Ibadan Univ. (Nigeria) Dept. of Agronomy.
E. J. Udo.
Soil Science Society of America Journal, Vol. 42, No. 4, p 556-560, July-August, 1978. 2 fig, 3 tab, 22 ref, 15 equ.

Descriptors: *Thermodynamics, *Cation exchange, Kaolinite, Potassium, Calcium, Magnesium, Ad- sorption, Isotherms, Selectivity, *Soil profiles.

Thermodynamic parameters derived from experi- mental results were determined for the potassium- calcium and magnesium-calcium exchange reactins on a kaolinitic soil clay separated from the B horizon of a strongly weathered soil profile. The clay samples were equilibrated at 10 and 30C with a mixed solution of KCl and CaCl2 for the K-Ca system or MgCl2 and CaCl2 for the Mg-Ca system. For the K-Ca system, the selectivity coeffi- cients were high indicating a greater affinity of the clay for K than for Ca. The high equilibrium constant and the negative values of standard free energy and enthalpy changes for the exchange of Ca for K also revealed a preference of the clay for K relative to Ca ions. In the Mg-Ca system, the exchange isotherms and the low selectivity coeffi- cients indicated a preference of Ca ions for the clay phase. This exchange of Ca for Mg was accompanied by an increase in the free energy and enthalpy changes also pointing to a more stable Ca-clay than Mg-clay. (Skogerboe-Colorado State)
W79-04209

COPPER AND CADMIUM ADSORPTION CHARACTERISTICS OF SELECTED ACID AND CALCAREOUS SOILS,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy.
N. Cavallaro, and M. B. McBride.
Soil Science Society of America Journal, Vol. 42, No. 4, p 550-556, July-August, 1978. 9 fig, 2 tab, 27 ref.

Descriptors: *Heavy metals, *Copper, *Cadmium, *Cation adsorption, Ion exchange, Acidic soils, Calcareous soils, Soil chemistry.

Samples of two New York soils, an acid and a neutral silt loam, were equalibrated with Cu(2+) and Cd(2+) solutions in concentrations ranging from 0.00001 to 0.0001 M in distilled water and in 0.01M CaC12. The extent of complexation and adsorption of the heavy metals was measured using specific electrodes and atomic absorption. The data were found to fit the Langmuir adsorption model, and the Cu(2+) adsorption maxima were greater than those of Cd(2+) for both soils. Acid soils demonstrated much less ability to retain the heavy metals than neutral soils. In the presence of 0.01M CaC12, adsorption of the metals was much re- duced, suggesting Ca(2+) competition for adsorp- tion sites. A considerable amount of Cu(2+) was complexed in the soil solutions, but Cd(2;) com- plexation was much less evident. The results sup- port an ion exchange mechanism of adsorption in the surface soils, and suggest that precipitation occurs in calcareous subsoils. (Skogerboe-Colora- do State)
W79-04210

ATRAZINE MOBILITY IN TWO SOILS UNDER CONVENTIONAL TILLAGE,
Pennsylvania Agricultural Experiment Station, University Park. Dept. of Soil Chemistry and Weed Science.
For primary bibliographic entry see Field 2G.
W79-04212

IMPORTANCE OF THE ORGANIC PHOSPHO- RUS FRACTION IN EXTRACTS OF CALCARE- OUS SOIL,
Cotton Research Center, Phoenix, AZ.
J. L. Abbott.
Soil Science Society of America Journal, Vol. 42, No. 1 p 81-85, January-February, 1978. 2 fig, 8 tab, 10 ref.

Descriptors: *Soil analysis, Calcareous soils, *Phosphorus, Forage sorghum, *Fertilizers, Or- ganic compounds, Soil chemistry.

Laveen clay loam soil samples were collected im- mediately following the harvest of forage sorghum (Sorghum bicolor (L.) Moench). Two sets were prepared before growing turnips (Brassico rapa L.) as the test crop in the greenhouse. One set was without treatment and the other, to simulate winter and spring conditions, was incubated for 20 days after addition of N and dextrose. Phosphorus uptake by turnips and changes in soil P forms were positively correlated with corresponding measure- ments taken during the growth of the sorghum crop. Correlations among P uptake by forage sor- ghum, turnips, and soil P measurements indicated their value in predicting available P. Prediction values for two of the procedures were improved by including the extractable organic P with the inorganic P for the incubated soil. Results showed that (1) time of sampling, (2) the crop to be grown, (3) the method of extraction, and (4) the means of converting organic P to a measureable inorganic form in the extract are of prime concern in decid- ing when to include extractable organic P in the P evaluation of a given soil. (Skogerboe-Colorado State)
W79-04213

THE DISTRIBUTION OF MICRONUTRIENT CATIONS IN SOIL UNDER CONDITIONS OF VARYING REDOX POTENTIAL AND PH,
Kentucky Agricultural Experiment Station, Lex- ington. Dept. of Agronomy.
J. L. Sims, and W. H. Patrick, Jr.
Soil Science Society of America Journal, Vol. 42, No. 2, p 258-262, March-April, 1978. 5 tab, 19 ref.

Descriptors: Iron, Manganese, Zinc, Copper, *Or- ganic matter, *Nutrient removal, Flooding, Toxic- ity, *Hydrogen ion concentration.

A laboratory study was conducted to determine the influence of redox potential and soil pH on the distribution of Fe, Mn, Zn, and Cu in Mhoon silty clay loam soil (Tupic Fluvaquents) and to provide insight into factors affecting micronutrient dissolu- tion and mobility in soil. Generally, greater amounts of Fe, Mn, Zn, and Cu were found in the Na acetate (exchangeable) and pyrophosphate (or- ganic) extractions at low pH and Eh than at high pH or Eh. In contrast, the amounts (except Mn) in the water-soluble, NH20H.HC1, and oxalate frac- tions were greater at high pH or Eh. Although the micro-nutrients were brought into solution at low pH and Eh, much of the soluble cations soon associated with the exchangeable and organic frac- tions. After reduction, mobilized Fe associated about equally with the exchangeable, organic, and NH20H.HC1 fractions; immobilized Mn with the exhangeable and water-soluble fractions; mobilized Zn with the organic fraction; and the mobilized Cu with the organic and water-soluble fractions. Sepa- ration of the water-soluble fraction into free ions and those complexed by soluble organic matter indicated that micronutrient cations were com- plexed by organic matter to a greater extent in reduced soil. (Skogerboe-Colorado State)
W79-04214

FATE OF FERTILIZER NITRATE APPLIED TO COASTAL BERMUDAGRASS ON A SWELLING CLAY SOIL,
Agricultural Research Service, Temple, TX. Blackland Conservation Research Center.
D. E. Kissel, and S. J. Smith.
Soil Science Society of America Journal, Vol. 42, No. 1, p. 77-80, January-February, 1978. 3 tab, 16 ref.

Descriptors: Nitrates, Denitrification, Fertilizers, Bermudagrass, Soil physical properties.

The disposition of N fertilizer applied to Coastal bermudagrass in the field over two growing sea- sons was determined by applying 560 kg N/ha as Ca(NO3)2 tagged with 7.599 atom % 15N to a

field microplot during 1974 and measuring various components of the N balance. Plant uptake of residual N was measured during 1975. Forty-nine percent of the applied N was recovered in harvested forage in 1974. About 40% of the applied N remained in the soil as residual N at the end of 1974. About 10% of the N was unaccounted for, indicating that denitrification losses were no more than 10% of the applied N. Most of the residual N at the end of the first growing season was immobilized N or was present in the root system of the grass. Immobilization is, therefore, a major factor causing low recovery of applied N by Coastal bermudagrass on swelling clay soils. Moreover, since only 17% of the residual N was recovered in forage during 1975 (7% of the N applied in 1974), most of the immobilized N was not available the following year. (Skogerboe-Colorado State)
W79-04215

POTASSIUM AND RUBIDIUM ADSORPTION AND DIFFUSION IN SOIL,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
V. C. Baligar, and S. A. Barber.
Soil Science Society of America Journal, Vol. 42, No. 2, p. 251-254, March-April 1978. 2 fig, 4 tab, 10 ref, 6 equ.

Descriptors: *Cation adsorption, Cation exchange, *Potassium, Cations, Diffusion, Correlation analysis, Organic matter, *Ribidium.

The adsorption of K and Rb by four soils was investigated to determine the differences in adsorption of K and Rb which may occur and how they are affected by soil properties with the view of using this information to evaluate the uptake mechanisms for K and Rb by plant roots growing in soil. Rubidium was adsorbed preferentially to K by all four soils. Selectivity coefficient k sub Rb/K, indicating the size of the effect ranged from 1.9 to 4.4. Adding K decreased k sub Rb/K, increased the amount of nonexchangeable Rb and decreased exchangeable Rb. There was a negative correlation (coefficient of determination = 0.78) between exchangeable K in the soil and k sub Rb/K. The level of K in the soil had a greater effect on k sub Rb/K than varying types of exchange sites present due to differences in clay and amount of organic matter in the four soils investigated. The size of the selectivity coefficient indicated that the difference between K/Rb ratios in the solution and exchange phases of these soils used and differences between soils made them suitable for use in plant uptake studies of the mechanisms of K and Rb uptake. (Skogerboe-Colorado State)
W79-04216

ADSORPTION OF ALDICARB BY CLAYS AND SOIL ORGANO-CLAY COMPLEXES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Science.
J. R. Supak, A. R. Swoboda, and J. B. Dixon.
Soil Science Society of America Journal, Vol. 42, No. 2, p 244-248, March-April, 1978. 3 fig, 3 tab, 22 ref.

Descriptors: Carbamate pesticides, Systemics, Insecticides, *Adsorption, Montmorillonite, Illite, Kaolinite, *Clay minerals.

Adsorption experiments conducted with S-methyl-14C-aldicarb resulted in what appeared to be negative adsorption (exclusion) of the toxicant on Ca- and Al- saturated montmorillonite clays. Calculated exclusion volumes indicated that aldicarb did not penetrate the interlamellar region. Aldicarb was excluded from at least the first 16 layers of water on external surfaces of montmorillonite. Positive adsorption occurred with Ca- and Al-saturated illite and kaolinite clays. Equilibration of aldicarb solutions with one acid and two calcareous Vertisols, and with the organo-clay complexes isolated from these Vertisols, produced negative adsorption isotherms for the acid and positive adsorption isotherm for calcareous adsorbents. (Skogerboe-Colorado State)
W79-04217

MULTICOMPONENT CATION ADSORPTION DURING CONVECTIVE-DISPERSIVE FLOW THROUGH SOILS: EXPERIMENTAL STUDY,
Utah State Univ., Logan. Dept. of Soils and Biometeorology.
S-H. Lai, J. J. Jurinak, and R. J. Wagenet.
Soil Science Society of America Journal, Vol. 42, No. 2, p 240-243, March-April, 1978. 5 fig, 14 ref, 2 equ.

Descriptors: *Cation adsorption, Cation exchange, *Soil water movement, Solutes, Sodium, Magnesium, Calcium, Isotherms.

The adsorption of H(+), Mg(2+), and Ca(2+) from aqueous solutions flowing through soil was examined under different total cation concentrations and input pulse volumes. The pulses of H(+) and Mg(2+), which were introduced into a Ca(2+)-saturated Yolo loam soil column, appeared separately in the effluent. The degree of separation decreased with total concentration, but was not affected significantly by the pulse volume. At constant total concentration, the initial appearance of the H(+) pulse in the effluent was not affected by input volume; the appearance of the Mg(2+) pulse was delayed with increasing pulse volume. The experimental results were compared to theoretical calculations based on a single component linear equilibrium model. At a low loading (a small amount of adsorbate with respect to a large amount of adsorbent), the agreement of the theoretical model and the experimental results was satisfactory. However, when the loading was increased, the discrepancy between the calculated values and the experimental results increased. (Skogerboe-Colorado State)
W79-04218

DISPOSITION OF 15N-LABELED FERTILIZER NITRATE APPLIED DURING CORN CULTURE IN FIELD LYSIMETERS,
Science and Education Administration, Temple, TX. Grassland-Forage Research Center.
For primary bibliographic entry see Field 3F.
W79-04223

THE AUTOMATIC DETERMINATION OF PPB LEVELS OF AMMONIA, NITRATE PLUS NITRITE, AND PHOSPHATE IN WATER IN THE PRESENCE OF ADDED MERCURY (II) CHLORIDE,
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Soils.
J. O. Skjemstad, and R. Reeve.
Journal of Environmental Quality, Vol. 7, No. 1, p 137-141, January-March, 1978. 4 fig, 3 tab, 17 ref.

Descriptors: *Ammonia, *Nitrates, Nitrites, *Phosphates, Preservation, Chemical analysis.

Three automated procedures are reported for the simultaneous determination of ammonia, nitrate plus nitrite, and phospate in water. The ammonia determination is based on the salicylate-dichloroisocyanurate reaction in the presence of nitroprusside preceded by in-line distillation. Nitrate plus nitrite is estimated by using an in-line copperized cadmium reductor, diazotizing the nitrite with sulphanilamide, and coupling with N-1-naphtylethylenediamine. Phosphate is estimated by reaction with molybdate and reduction to molybdenum blue with ferrous ammonium sulphate. Mercury (II) chloride used as a preservative does not interfere with the methods and good precision at ppb levels can be obtained. (Skogerboe-Colorado State)
W79-04226

A NEW APPROACH TO SOIL TESTING: III. DIFFERENTIAL ADSORPTION OF POTASSIUM,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
W. L. Stout, and D. E. Baker.
Soil Science Society of America Journal, Vol. 42, No. 2, p 307-310, March-April, 1978. 1 fig, 7 tab, 17 ref, 10 equ.

Descriptors: *Soil tests, *Potassium, Cation adsorption, Nutrient requirements, Cation exchange, *Soil chemical properties, Regression analysis.

Donnan type ratios were used to develop an index to account for the differential adsorption of K in two widely differnt soils of the Rayne and Hublersburg series. This index was used to calculate and adjusted K requirement for the soils using the approach of Baker. Three corn hybrids (Zea mays L.) were grown in the two soils reated with different level of K and multiple regression analysis was used to relate soil test varibables to plant K content. Most of the variation in the index, K sub E/S, was associated with soil effects, making the index useful in characterizing the two soils with respect to differential K adsorption and in calculating soil K requirements. Over 60% of the variation in plant K content was explained by the soil K requirement calculated from he index. Compared with a critical K level of 98 ppm exchageable K for soils with a CEC of 10 mez/100 g and a K sub E/S of 1.0, the comparable critical values for K were 71 ppm for the Rayne and 114 ppm for the Hublersburg. (See W74-08281). (Skogerboe-Colorado State)
W79-04227

COLORIMETRIC DETERMINATION OF UREA IN SOIL EXTRACTS USING AN AUTOMATED SYSTEM,
Melbourne Univ., Parkville (Australia). Faculty of Agriculture and Forestry.
L. A. Douglas, H. Sochtig, and W. Flaig.
Soil Science Society of America Journal, Vol. 42, No. 2, p 291-292, March-April, 1978. 1 fig, 1 tab, 2 ref.

Descriptors: *Ureas, Colorimetry, Analytical techniques, Inhibitors, *Soil tests, Automation.

A method is described for using an automated system to determine urea in 2M KCl soil extracts that contain a urease inhibitor (phenylmercuric acetate). The method is sensitive and precise and allows 90-120 extracts to be analysed per day. (Skogerboe-Colorado State)
W79-04228

INHIBITION OF UREASE ACTIVITY BY HETEROCYCLIC SULFUR COMPOUNDS,
Alberta Univ., Edmonton. Dept. of Soil Science.
W. D. Gould, F. D. Cook, and J. A. Bulat.
Soil Science Society of America Journal, Vol. 42, No. 1, p 66-71, January-February, 1978. 3 fig, 5 tab, 30 ref.

Descriptors: *Urea, Nitrogen, *Nitrification, Inhibitors, Sulfur compounds, Volatility, Hydrolysis, Soil investigations.

The inhibition of both jack bean urease and soil urease by several heterocyclic mercaptans was investigated. The following compounds not previously tested as urease inhibitors were found to be effective inhibitors of jack bean urease: 1,3,4-thiadiazole-2,5-dithiol; 5-mercapto-3-phenyl-1-1,3,4-thiadiazole-2-thione; and 5-amino-1,3,4-thiadiazole-2-thiol. The disulfides of the latter two compounds were found to be very potent inhibitors of jack bean urease. The results are consistent with an inhibition mechanism involving a thiol-disulfide exchange reaction between a disulfide and one or more of the sulfhydryl groups of urease. The results also imply that inhibition of urease by the heterocyclic mercaptans was due to trace amounts of the corresponding disulfides or polysulfides in the mercaptan preparations. A number of heterocyclic mercaptans, two disulfides, and a number of known urease inhibitors were evaluated as soil urease inhibitors, and the following compounds were the most effective: 1,4-benzoquinone; hydroquinone > 2,5-dimethyl-1-1,4-benzoquinone; catechol; 1,3,4-thiadiazole-2,5-dithiol; 2,6-dimethyl-1,4benzoquinone. (Skogerboe-Colorado State)
W79-04233

A NEUTRON ACTIVATION METHOD FOR DETERMINING SUBMICROGRAM SELENIUM IN FORAGE GRASSES,

Missouri Univ.-Columbia. Dept. of Agronomy.
For primary bibliographic entry see Field 2I.
W79-04235

EXTRACTABILITY OF 238PU AND 242CM FROM A CONTAMINATED SOIL AS A FUNCTION OF PH AND CERTAIN SOIL COMPONENTS: HNO3-NAOH SYSTEM,
California Univ., Los Angeles, Lab. of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 2G.
W79-04236

GEOCHEMISTRY OF GEOPRESSURED GEOTHERMAL WATERS FROM THE TEXAS GULF COAST,
Geological Survey, Menlo Park, CA. Water Resources Div., and Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 1A.
W79-04414

2L. Estuaries

CARBON REQUIREMENTS OF A POPULATION OF THE ESTUARINE COPEPOD EURYTEMORA AFFINIS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
D. R. Heinle, and D. A. Flemer.
Marine Biology, Vol. 31, p 235-247, 1975. 6 fig, 6 tab, 56 ref. OWRT B-014-MD(2).

Descriptors: *Algae, *Microorganisms, *Patuxent River, *Maryland, *Eurytemora affinis, Nutrient requirements, Carbon, Estuarine environment, Biomass, Sampling, Measurement, Aquatic microorganisms, Copepods.

The carbon requirements of Eurytemora affinis produced in the Patuxent River estuary (Maryland) are reported. The general features and physical characteristics of the study area are described, and the methods and materials used are discussed. Total carbon concentrations decreased at the upstream stations and increased at the downstream stations during this study. Productivity of the E. affinis was measured and was found to approximate expected productivity. Low productivity in the downstream populations were the result of low proportions of egg-bearing females, while low productivity rates at upstream stations were due to limited food supply. E. affinis carbon demand was calculated from population biomass, and productivity measured as a rate of production of eggs. The carbon demand of E. affinis exceeded gross primary production by 2 to 75-fold from March through May at some stations. The greatest carbon demand in excess of algal production occurred during April. It is estimated that the detrital (non-algal and non-copepod) carbon is used to meet part of the energy requirements of E. affinis during March, April, and May. Turnover times, calculated for all occasions when carbon demand exceeded primary production, were between 8 and 83 days. It was assumed that all primary production was consumed by E. affinis. (Davison-IPA)
W79-04011

DREDGED MATERIAL RESEARCH PROGRAM, FOURTH ANNUAL REPORT.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 6G.
W79-04044

UPPER LAYER OBSERVATIONS AND SIMULATION USING KRAUS AND TURNER'S MODEL IN THE GULF OF FINLAND,
Helsinki Univ. (Finland). Dept. of Geophysics.
M. Tyrvainen.
Nordic Hydrology, Vol. 9, No. 3/4, p 207-218, 1978. 9 fig, 3 tab, 8 ref.

Descriptors: *Temperature, *Water temperature, *Thermocline, *Model studies, Mathematical models, Mixing, Radiation, Solar radiation, Heat transfer, Winds, Humidity, Clouds, On-site data collections, Sampling, Oceanography, Estuaries, *Finland, *Gulf of Finland.

There are strong seasonal variations in the depth of the thermocline and in the sea surface temperature in the western part of the Gulf of Finland. A numerical model was used to calculate the depth of the thermocline and the temperature of the mixed layer from June to October in 1969 and 1974. Observed daily mean values of total incoming radiation, air temperature, wind velocity, air humidity, and cloudiness were used as input data from which the thermal energy balance on the sea surface was calculated. The model is sensitive to the drag coefficient of the wind and to the absorption coefficient of the solar radiation for which the values c sub D = 0.0008 and Beta = 0.25/m were used. For the mixed layer temperature, the results of the model are 2-4 deg C too small. The depth of the thermocline can be predicted with an accuracy of + or -5 meters. (Sims-ISWS)
W79-04045

MIXING IN SHALLOW COASTAL SEA: CASE STUDY,
New Jesey Dept. of Environmental Protection, Trenton. Delaware River Water Quality Planning.
For primary bibliographic entry see Field 5B.
W79-04049

FORAMINIFERA, DIATOM AND BIVALVE DISTRIBUTION IN RECENT SEDIMENTS OF THE HUDSON ESTUARY,
City Coll., New York. Dept. of Earth and Planetary Sciences.
D. Weiss, K. Geitzenauer, and F. C. Shaw.
Estuarine and Coastal Marine Science, Vol. 7, No. 4, p 393-400, October 1978. 3 fig, 22 ref.

Descriptors: *Hudson River, *Estuaries, *Marine biology, Diatoms, Benthic flora, Benthic fauna, Sediments, Salinity, Temperature, Water temperature, Dissolved oxygen, Sampling, Surveys, Biology, *Hudson Estuary, Bivalves, Foraminifera.

Foraminifera, diatoms, and bivalves, collected in channel and traverse samples along the lower 184 km of the Hudson Estuary in 1974-1975, showed distinctive distributions along the length of the estuary. Typical assemblages of these potential fossils were designated which correspond approximately to a decrease in salinity northward in the estuary. In general, only freshwater forms were found north of Peekskill, low brackish-water forms penetrated as far south as mid-Manhattan, high brackish-water forms were found as much as 16 km north of this, while normal marine faunas did not penetrate significantly northward of New York Harbor. This paper, in addition to providing baseline data on the present day distribution of these taxa, also defined potential fossil assemblages. These assemblages should prove useful in interpreting past salinity gradients in the Estuary when adequate cores become available. (Sims-ISWS)
W79-04056

ROCKY BOTTOM FAUNA IN A SUBMARINE GULLEY AT LOPPKALVEN, FINNMARK, NORTHERN NORWAY,
Tromsoe Univ. (Norway). Marine Biological Station.
B. Gulliksen.
Estuarine and Coastal Marine Science, Vol. 7, No. 4, p 361-372, October 1978. 6 fig, 2 tab, 9 ref.

Descriptors: *Benthic flora, *Benthic fauna, *Coasts, *Gullies, Marine biology, On-site investigations, Sampling, Marine algae, Marine plants, Marine animals, Biomass, Tides, Tidal effects, Waves(Water), Topography, Water temperature, Salinity, Light, Photography, Scuba diving, Biology, *Norway.

Vertical and horizontal distribution of macrobenthic flora and fauna were investigated on the vertical, rocky walls of a submarine gulley at Loppkalven (70 deg 18 min N, 21 deg 22 min E) in Northern Norway. The length of the gulley was 55 m at the water surface, and the water depth was 12 m near the opening. Less than 1% of the surface light at the opening was recorded near the bottom (6-8 m depth) in the inner parts. Brown algae and non-calcareous red algae were absent, even in the tidal zone, at the terminal end of the gully. Porifera, anthozoans, hydrozoans, and bryozoans were the most common sessile animals, and they showed clear vertical and horizontal gradients in their distributions. The amphipods Ischyrocerus anguipes, Sympleustes glaber and Stenothoe monoculoides, the bivalve Hiatella arctica, and the polychaete Eulalia viridis, were the most abundant solitary animals. The distribution of these amphipods and M. helicinus seemed to have the same distribution pattern as either non-calcareous algae or tuft-like bryozoans. (Sims-ISWS)
W79-04057

TURBIDITY MAXIMA IN PARTIALLY MIXED ESTUARIES: A TWO-DIMENSIONAL NUMERICAL MODEL,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Lab.
J. F. Festa, and D. V. Hansen.
Estuarine and Coastal Marine Science, Vol. 7, No. 4, p 347-359, October 1978. 9 fig, 18 ref.

Descriptors: *Turbidity, *Estuaries, *Model studies, Mathematical models, Sediments, Suspended solids, Particle size, Circulation, Water circulation, Sediment transport, Settling velocity, Tidal effects, Tidal waters, Rivers, Oceans, *Turbidity maxima.

A steady-state numerical model was developed to help explain the prescence of the turbidity maximum in partially mixed estuaries. The model supports the hypothesis that estuarine dynamics are primarily reponsible for its occurrence. The magnitude and location of the turbidity maximum were shown to depend upon the settling velocity (particle size) of the sediment, the amount of sediment introduced at both the ocean and river source, and the strength of the estuarine circulation. This phenomenon was not simply related to the river input of sediments since results showed the existence of a turbidity maximum for a sediment source which is predominately oceanic. Sediment flux stream functions showed the presence of a closed cell when a turbidity maximum exists. (Sims-ISWS)
W79-04058

MEAN UPWELLING VELOCITIES ON THE OREGON CONTINENTAL SHELF DURING SUMMER 1973,
Woods Hole Oceanographic Institution, MA.
H. L. Bryden.
Estuarine and Coastal Marine Science, Vol. 7, No. 4, p 311-327, October 1978. 4 fig, 4 tab, 24 ref. NSF OCE76-80066, OCE77-2287.

Descriptors: *Upwelling, *Continental shelf, *Oregon, *Model studies, Mathematical models, Heat balance, Velocity, Oceans, Currents(Water), Ocean currents, Ocean circulation, Coasts, Winds, Temperature, Summer, Oceanography, *Upwelling velocities, *Oregon coast waters.

Mean vertical velocities for a 56-day period during Summer 1973 were estimated from consideration of the heat balance and mass conservation at a mid-shelf location in the coastal waters off Oregon. In the heat balance, vertical velocity is required to carry cold water upward predominantly to balance horizontal advection of warm water toward the coast by onshore velocities below 20 m depth. In the conservation of mass, vertical velocity is required to transport water upward to balance the onshore transport below 20 m. The two sets of vertical velocities at four depths agreed within 0.002 cm/s, which is less than their estimated errors. The upward velocities were found to increase from 0.003 cm/s at 87.5 m to 0.016 cm/s at 30 m depth. These vertical velocities are as large as those estimated previously during upwelling events of a few days duration. Because they are time-averages over almost two months, these mean vertical velocities are likely to be more important than

the event-scale vertical velocities in the coastal circulation. Comparisons of observed onshore and offshore transports with the wind-driven offshore transport predicted by simple models suggested that the coastal circulation is a factor of 3 larger than that predicted from observed local winds. (Sims-ISWS)
W79-04059

A STUDY OF LOUISIANA'S MAJOR ESTUARIES AND ADJACENT OFFSHORE WATERS,
Louisiana Wildlife and Fisheries Commission, New Orleans.
B. B. Barrett, J. L. Merrell, T. P. Morrison, M. C. Gillespie, and E. J. Ralph.
Technical Bulletin No. 27, April 1978. 197 p, 1 append.

Descriptors: *Water properties, *Water quality standards, *Water chemistry, *Estuaries, *Louisiana, Salinity, Turbidity, Water temperature, Dissolved oxygen, Water depth, Data collection, Nitrogen, Zooplankton, Nekton, Microorganisms, Area distribution, Biology, Estuarine fisheries, Estuarine environment, Coasts, Invertebrates, Vertebrates.

This report presents data on seven of Louisiana's major estuaries and adjacent offshore waters which were sampled monthly from October 1974 to September 1976. The samples provided information on the water bodies' physical properties, chemistry, amount of nekton, zooplankton, and chlorophyll a. Characteristics of physical properties include water depth, tides, sea states, salinity, temperature, and area rainfall. The data are presented in tables and figures. The water chemistry was analyzed in relation to DO levels, turbidity, nitrate-nitrite values, ammonia levels, total nitrogen and phosphorus amounts, and other related chemical properties. A systematic survey of all zooplankton organisms with the appropriate conditions under which they were collected is presented in various charts and figures. Also, a systematic account of both vertebrate and invertebrate species found in the waters is presented with Latin names, characteristics of the species, and major habitats. When evident, correlations and interrelationships among the various parameters are presented along with tabular information on all measurements made during the study. The variability of the parameters sampled were primarily the result of one or more of the following factors: amount of freshwater introduction, season, and proximity to oceanic waters. An extensive appendix lists area, station, dates, and levels of all parameters collected. (Coan-NC)
W79-04156

SUSPENDED SOLIDS IN WATER.
Plenum Press (New York and London). 1974. 320 p. Gibbs, R. J. (editor).

Descriptors: *Suspended solids, Oceans, Settling velocity, Conferences, Water properties, Turbidity, Physical properties, Storms, Chesapeake Bay, Natural streams, Refractivity, Instrumentation, Calibrations, Sediment transport, Continental shelf, Africa, Foreign countries, South America, Atlantic Ocean, Tropical regions, Benthos, Gulf of Mexico, Surface waters, Chemical reactions, Optical techniques, Light scattering, Caribbean Sea, Atlantic trough.

Principles of studying suspended matter and its settling rate, principles of optical techniques, nearshore and offshore studies are the main categories of 19 technical papers by different authors originally presented at a symposium held March 20-22, 1973, in Santa Barbara, California, sponsored by the U.S. Office of Naval Research. This volume is an edited compilation of the symposium proceedings. (Brown-IPC)
W79-04258

RIVERINE INFLUENCE ON ESTUARIES: A CASE STUDY,
Alabama Univ., Dauphin Island. Marine Science Programs.
W. W. Schroeder.
In: Estuarine Interactons, p 347-364, 1978. 12 fig, 1 tab, 11 ref. Academic Press, New York. OWRT A-058-ALA(1).

Descriptors: *Discharge rate, *Tides, Wind, Salinity variatons, *Estuaries, Mobile Bay.

The Mobile Bay, Alabama estuary is a moderate-size, shallow, semi-enclosed coastal embayment with a simple triangular shape and a small tidal amplitude. It is also the terminus of the fourth largest river system in the United States, in terms of discharge, and the sixth largest on the North American continent. The average discharge of the Mobile River System is approximately 1,750 m3sec-1 and the 10 and 90 percentile discharges are approximately 4,250 and 379 m3sec-1, respectively. Waters from the system have a multi-faceted impact on the Mobile Bay. Discharges in excess of 7,000 m3sec-1 are considered flooding and if they prevail over extended periods (10 to 15 days), can turn most of the bay into a near limnetic environment. Low-flow intervals, discharges less than 500 m3sec-1, allow the upper bay waters to reach salinities >26 ppt. Between these extreme conditions the river waters exhibit a variety of dispersion patterns as a function of specific discharge rate, local wind fields and amplitude of the astronomical tide, which results in significant longitudinal, lateral, and vertical salinity variations.
W79-04350

HYDRAULICS IN THE COASTAL ZONE.
Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, New York, 1977. Cost $16.00.

Descriptors: *Tidal waters, *Conferences, *Hydraulics, *Coasts, *Estuaries, Publications, Flow, Tidal effects, Coastal structures, Shore protection, Groundwater, Aquifers, Beaches, Mathematical models, Model studies, Wave pile-up, Inlets(Waterways), Hydraulic structures, Land subsidence, Fish handling facilities, Fish barriers, Dredging, Erosion, Beach erosion, Stratified flow, Hydraulic models, Channel flow, Canals, Jets, Waves(Water), Water pollution, Dispersion, Scour, Analytical techniques, *Tidal hydraulics.

The purpose of the conference was to focus attention on hydraulics in the coastal zone. Subject areas covered the 46 papers included: tidal hydraulics mathematical models, tidal hydraulics, hydraulic structures, groundwater, hydraulic transport, groundwater-surface water, hydromechanics, fish handling structures, land subsidence, dredged material disposal, waterways inlets, and estuaries. (See also W77-08335, W78-05422, W78-06186 and W79-04352 thru W79-04388) (Humphreys-ISWS)
W79-04351

COMPARISON OF NUMERICAL SIMULATION FLOW MODELS FOR COASTAL INLETS,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
J. L. Machemehl, and T. C. Gopalakrishnan.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, Aug 10-12, 1977. American Society of Civil Engineers, New York, p 1-10, 1977. 3 fig, 3 ref. NOAA Grant 04-6-158-44054.

Descriptors: *Inlets(Waterways), *Model studies, *North Carolina, Coasts, Numerical analysis, Analytical techniques, Finite element analysis, Flow, Tidal waters, Mathematical models, Currents(Water), *Masonboro Inlet(NC), Galerkin techniques.

A numerical simulation model for the computation of flow in inlets wit junctions was developed. This model used the Galerkin Technique with a finite element analysis. The vertically integrated equations of momentum and mass conservation were used with the appropriate boundary and initial conditions. The finite element model was used to investigate the flow in Masonboro Inlet, North Carolina. The junction conditions were introduced by the time rates of change of energy and mass flux at the junctions. The effectiveness of the 'double sweep' approach in solving the flow dynamics was described, along with a discussion of appropriate shape functions. The computer results from the finite element scheme were compared with the field data and with the results from the finite difference schemes. The analysis of the inlet required approximately 1 min on the IBM 370 for a tidal cycle. The Galerkin finite element analysis of flow was found to provide good accuracy considering the complex nature of the phenomenon. (See also W79-04351)(Humphreys-ISWS)
W79-04352

A SET OF COORDINATED MATHEMATICAL MODELS FOR THE COASTAL ZONE,
University of South Florida, Tampa. Coll. of Engineering.
B. E. Ross, M. W. Anderson, and P. Jerkins.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 11-18, 1977. 6 fig, 15 ref.

Descriptors: *Mathematical models, *Coasts, *Estuaries, *Florida, Water quality, Inlets(Waterways), Tidal waters, Floods, Model studies, Analytical techniques, Dredging, Water levels.

A brief expose of some aspects of a coordinated set of mathematical models was presented. The state of development of the models is sufficient that consulting engineers, with a reasonable knowledge of modeling, can obtain useful results. The set of models included an estuary or near shore coastal zone hydraulic model which has the capability of simulating various flow boundary conditions such as submerged islands, channels, causeways, etc. Also included in the set as subroutines were an advanced hurricane subroutine, a water quality subroutine, a power plant siting subroutine and a dredging-sediment transport subroutine. The basic model was supplemented by wave refraction-diffraction and wind driven wave programs. A coastal sediment transport model is under development to find use in beach erosion problems of the Tampa Bay Region. Examples of the types of coastal zone problems that have been successfully resolved utilizing these mathematical models were presented. A partial list of these included (1) the location and sizing of bridges in a causeway, (2) complete water quality studies for various areas, (3) the establishment of hurricane flood tide elevations for the Tampa Bay Region, (4) an evaluation of the effects of dredge and fill in Boca Ciega Bay, Florida and (5) the shoaling of Clearwater, Florida. (See also W79-04351) (Humphreys-ISWS)
W79-04353

A THREE-DIMENSIONAL NUMERICAL MODEL OF ESTUARINE CIRCULATION,
Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
R. B. Gordon, and M. L. Spaulding.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 19-27, 1977. 8 fig, 7 ref.

Descriptors: *Estuaries, *Water circulation, *Model studies, Mathematical models, Numerical analysis, Salinity, Currents(Water), Finite element analysis, Tidal waters, Circulation, Water quality, Analytical techniques, Spatial distribution, *Providence River(RI).

This paper described the development of a three-dimensional numerical model of circulation and salt distribution was described. This coordinate transformation has the advantage of mapping the free surface and bottom boundaries onto coordi-

nate surfaces and allows for a uniform vertical grid resolution throughout the modeled region. It also results in some distinct advantages over previous, arbitrarily layered approaches. Explicit finite-differences were used to approximate the system of coupled, non-linear partial differential equations. The computational tests described suggest the suitability of the numerical technique for simulating three-dimensional flows in estuaries with non-uniform density distributions. (Humphreys-ISWS)
W79-04354

INTAKE SCREENWELL SURGING CAUSED BY WAVE DYNAMICS,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 8A.
W79-04357

IMPROVED DRAG FORCE LINEARIZATIONS FOR STRUCTURAL DYNAMIC CALCULATIONS,
McDermott (J. Ray) Co., Inc., New Orleans, LA.
For primary bibliographic entry see Field 8B.
W79-04358

DETERMINATION OF FLOOD LEVELS ON THE PACIFIC NORTHWEST COAST FOR FEDERAL INSURANCE STUDIES,
CH2M/Hill, Redding, CA.
D. E. Dorratcague, J. H. Humphrey, and R. D. Black.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Specialty Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 73-81, 1977. 8 fig, 10 ref.

Descriptors: *Flood stages, *Coasts, *Estuaries, *Oregon, *Washington, *Pacific coast region, Insurance, Tides, Flood frequency, Wave pile-up, Analytical techniques, Tidal waters, Flooding, Surges, Wind tides, Wave(Water), Flood recurrence interval, Flood zones, Storm surge.

The northern Oregon and southern Washington coastal areas that were studied are characterized by shallow sloping and sandy beaches below the high tide line and either sand dunes or rock cobble banks above the high tide line. In many areas, houses and motels have been built on these dunes and banks. A number of these existing and proposed structures are subject to ocean flooding and wave damage. Flood levels on the open coast are determined by a combination of astronomical tide and storm surge, which comprise the stillwater level, and storm wave runup. Not only must the magnitude of these three components be computed, but a frequency of occurrence must be assigned to their combined height. Established methods for computing astronomical tide and wave runup were combined with a storm surge computer model and extreme event statistics to provide an open coast flood computation procedure. A general flow chart of the procedure was given. It was found that this method produced flood levels that agreed well with high watermarks obtained during reconnaissance in the study areas. The storm surge model reproduced surge peaks with suitable accuracy but had some difficulty in reproducing surges in time. (See also W79-04351)(Humphreys-ISWS)
W79-04359

THE DYNAMICS OF THE COASTAL BOUNDARY WATERS OFFSHORE SOUTHERN NEW JERSEY,
Pandullo Quirk Associates, Wayne, NJ.
J. De Alteris, D. Shahrabani, J. Kroll, N. Papageorgis, and K. Konrad.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 82-89, 1977. 4 fig.

Descriptors: *Coasts, *New Jersey, *Tidal effects, *Storms, Oceans, Tidal waters, Currents(Water), Tides, Hurricanes, Analysis, Analytical techniques, Oceanography, Ocean currents, Unsteady flow, Waves(Water), On-site data collections, *Delaware Bay, *Middle Atlantic Bight.

The response of the southern New Jersey coastal waters to three types of meteorological events was described using observations of currents, waves, and tides. During summer doldrums, harmonically predictable tidal currents account for up to 80% of the energy in the current data. The influence of Delaware Bay mouth results in an amplification of the tidal currents in the southern portion of the study area. The transient response of the nearshore waters to a March Northeaster and Hurricane Belle was documented. In both cases, tidal currents were masked totally by an intense barotropic coastal jet generated by the wind stress. The storm-generated, barotropic, coastal jet currents appear to be influenced by the bay mouth, resulting in currents 1 fps greater in magnitude at Wildwood compared to Ocean City. (See also W79-04351) (Humphreys-ISWS)
W79-04360

TIDAL JET FLOWS NEAR INLETS,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
U. A. Unluata, and E. Ozsoy.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, Augut 10-12, 1977. American Society of Civil Engineers, New York, p 90-98, 1977. 8 fig, 11 ref.

Descriptors: *Inlets(Waterways), *Tidal waters, *Hydraulics, *Model studies, Jets, Mathematical models, Hydraulic models, Analytical techniques, Analysis, Flow, Tides, Flow characteristics, Tidal jet flows.

Turbulent jets issuing from tidal inlets during the ebb flows were analyzed, and the effects of bottom friction and one-dimensional depth variations were shown to change the jet behavior in a drastic way. Jets on a constant bottom with friction expand in an explosive manner. When the depth increases in the offshore direction, the expansion rate of the jet is greatly reduced. Measurements obtained in five individual experiments demonstrated fair agreement with the analytical solution. The analytical solutions were verified against field evidence and preliminary experiments. (See also W79-04351)(Humphreys-ISWS)
W79-04361

WAVE RUNUP ON IRREGULAR BEACH PROFILES,
MacLaren (James F.) Ltd., Toronto (Ontario).
A. T. K. Fok, and C. Marche.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 99-106, 1977. 6 fig, 1 tab, 6 ref.

Descriptors: *Beaches, *Waves(Water), *Coasta, *Model studies, Laboratory tests, Wave pileup, Hydraulic models, Analytical techniques, Analysis, Testing procedures, Measurement, Wave runup.

The primary purpose of this study was to determine the safe elevation of a coastal structure against possible flooding caused by wave runup. Physical model tests were conducted. This article described the criteria for selecting model scales, the testing facilities, the construction methods, experimental procedure, and the results. A comparison between theoretical and experimental approaches and a discussion of results obtained from different beach profiles were included. It was found that the theoretical approach underestimates the runup on the irregular beach profils of the study area. (See also W79-04351)(Humphreys-ISWS)
W79-04362

SALINITY DISTRIBUTION OF A HIGHLY STRATIFIED ESTUARY,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
Y. H. Wang.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 130-135, 1977. 4 fig, 3 ref.

Descriptors: *Estuaries, *Stratified flow, *Salinity, *Model studies, Distribution patterns, Profiles, Density, Mathematical models, Analysis, Analytical techniques.

A highly stratified estuary may be described as two superimposed streams of different densities (fresh- and saltwaters) and velocities. There are two types of problems that are often of interest: (1) to calculate the density distribution across the interfacial region for given flow conditions, and (2) to determine the interfacial stability for given density and velocity distributions. The first problem involves solving the equations of motion and diffusion equations simultaneously. The second problem deals with the solution of the Taylor-Goldstein equation with proper boundary conditions. It is desirable for both problems that an expression of the density profile with variable scales be devised. Natural occurrances and laboratory experiments about stratified free shear flows are often found having different vertical scales of velocity and density. The ratio of the two scales has an effect of the prediction of concentration distribution. The current paper tried to embed these two vertical scales into a density profile of a variable vertical scale. This 'versatile' density distribution was compared with laboratory measurements. (See also W79-04351) (Humphreys-ISWS)
W79-04364

THE FRESH WATER LENS IN A BARRIER BEACH,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
D. W. Urish.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 161-168, 1977. 5 fig, 9 ref.

Descriptors: *Groundwater, *Beaches, *Rhode Island, *Model studies, Freshwater, On-site investigations, Tidal waters, Groundwater movement, Coasts, Tidal effects, Analytical techniques, Freshwater lens.

Oceanic landmasses, under natural conditions, commonly develop a body of fresh groundwater. This freshwater body assumes the form of a lens floating on the underlying seawater and is usually thickest at the central part of the landmass tapering to a thin edge at the shore margins. With certain unique exceptions as described herein, the flow moves from the thickest part of the lens outward and upward to the shoreline. The extent of a freshwater lens depends primarily on landmass width, permeability, rainfall, and tidal range. (See also W79-04351) (Humphreys-ISWS)
W79-04367

EVALUATION OF A BARRIER AGAINST SEAWATER INTRUSION,
Los Angeles County Flood Control District, CA.
J. S. Angus.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Staton, August 10-12, 1977. American Society of Civil Engineers, New York, p 187-194, 1977. 4 fig.

Descriptors: *Groundwater, *Saine water intrusion, *Coasts, *Saline water barriers, Water Pollution sources, Analytical techniques, Analysis, Encroachment, Flow, Saline water.

Wherever the demand for freshwater from coastal aquifers approximates or exceeds the supply, seawater intrusion presents a serious problem. This paper dealt with studies made of functioning barriers to trace locations of suspected deficiencies and to determine if supplemental construction is warranted. A brief description of barriers was presented, followed by the means for detecting intrusion, types of data employed, preparation of data, and procedures for analyzing the data. The procedures are not sophisticated due to the nature of the data, and those described have proven useful in practical applications. It was concluded that: (1) Groundwater elevations, pressure gradients, and chloride concentrations data figure prominently in analyzing barrier effectiveness; (2) Chloride concentrations analyses is simplified when the water samples are obtained by a single method; and (3) Groundwater elevation measurement should be adjusted to reflect specific weight unless the intruded aquifer is near ground surface and the water is fresh or nearly so. (See also W79-04351)(Humphreys-ISWS)
W79-04370

DIFFRACTION OF WAVES BY A SHORE-CONNECTED BREAKWATER,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-04377

A GENERALIZED POINT-VELOCITY METHOD FOR DISCHARGE COMPUTATIONS IN TIDAL WATERWAYS,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
A. J. Mehta, E. J. Hayter, and B. A. Christensen.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 261-268, 1977. 2 fig, 1 tab, 3 ref. 1 append.

Descriptors: *Discharge(Water), *Tidal waters, *Inlets(Waterways), *Model studies, Analytical techniques, Analysis, Flow, Hydraulics, Mathematical models, Tidal streams, Computer programs.

An analytic method was described for a rational approach to relate the velocity measured by a current meter, at any given position in a non-stratified tidal waterway cross section, to the total discharge through the same section. A single set of cross-sectional velocity measurements is required for calibrating the equations with respect to the bed roughness k, given the cross-sectional geometry, measured discharged, tidal elevaltion and the slope of the energy grade line. With k known, the discharge Q may be determined for a given current meter speed and tidal elevation at any instant. An example illustrated the method where Q was determined as a function of time over at 45 hour period. The computer program was listed in an appendix. (See also W79-04351). (Humphreys-ISWS)
W79-04378

EXPERIMENTAL STUDIES OF BEACH SCOUR DUE TO WAVE ACTION,
Korean Ocean and Research Development Inst., Seoul (South Korea).
W. O. Song, and R. E. Schiller, Jr.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 328-335, 1977. 5 fig, 7 ref.

Descriptors: *Scour, *Beaches, *Model studies, *Coastal structures, Waves(Water), Erosion, Hydraulic models, Laboratory tests, Sea walls, Analytical techniques, Analysis, Beach erosion.

A series of experiments were conducted to investigate the processes involved in the formation of beach scour, caused by wave action on natural beaches and seawall beaches. Reflection coefficients were determined for the natural beach and for various seawall beaches by the envelope method and the Coastal Engineering Research Center (CERC) method. Results of the two methods agreed closely. The wave surface profiles and the corresponding horizontal and vertical velocity components of the water particles at designated points on the free water surface were calculated on the basis of linear standing wave theory and with second water order wave theory. Comparison of the two wave theories indicated that the linear standing wave theory gives good results as a first approximation. An equation to predict the scour depth at the toe of a seawall was developed by the use of regression analysis. (See also W79-04351)(Humphreys-ISWS)
W79-04386

EFFECTS OF AMBIENT CURRENT AND DENSITY STRATIFICATION ON BUOYANT JETS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resource.
For primary bibliographic entry see Field 5B.
W79-04387

TRANSPORTATION OF ORGANIC DETRITUS IN ESTUARIES,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
J. S. Fisher, and J. C. Pickral.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 344-351, 1977. 2 fig, 2 tab, 5 ref.

Descriptors: *Estuaries, *Detritus, *Model studies, *Laboratory tests, Salt marshes, Tidal waters, Water quality, Hydraulic models, Movement, Organic matter, Sediment transport, Particle size, Settling velocity, Analysis, Organic detritus.

The entrainment of benthic particulate organic detritus is predictable from a Shields diagram. The samples were collected from a small tidal satl marsh. A measurement of size and fall velocity appears to be sufficient to estimate the shear velocity at the initiation of motion. This paper presented the results of a series of laboratory flume studies intended to establish the threshold of motion for several different detrital samples as a function of the bottom shear stress. It was shown that is will be possible to predict when various types and sizes of particulate organic detritus begin to move on the bottom of a marsh. This information will be fundamental to a general analysis of the role of this material in the determination of water quality of these water bodies. (See also W79-04351) (Humphreys-ISWS)
W79-04388

APPROPRIATION FOR INSTREAM FLOW MAINTENANCE: A PROGRESS REPORT ON 'NEW' PUBLIC WESTERN WATER RIGHTS,
Indiana Univ., Bloomington.
For primary bibliographic entry see Field 6E.
W79-04438

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DETERMINATION OF THE TECHNICAL POTENTIAL OF THE LIME-MAGNESIUM CARBONATE PROCESS, VOLUME I,
Radian Corp., Austin, TX.
D. M. Ottmers, Jr., and T. J. Hubbard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 182, Price codes: A05 in paper copy, A01 in microfiche. OWRT/S--76/20, Vol. II, June 1972. 75 p. DOI 14-30-2952.

Descriptors: *Water treatment, *Carbon dioxide, *Calcium, *Mass transfer, Design, Chemical precipitation, Sea water, Flow rates, Engineering feasibility, *Magnesium carbonate, Model studies, *Pre-treatment(Water), Desalination, *Computer programs, Magnesium hydroxide, Alkaline scale, *Lime-magnesium carbonate processes, *Feed water treatment, *Calcium ions.

An engineering analysis has been made for the lime-magnesium carbonate (LMC) process. The response of the LMC process to variations in several operating conditions was determined. For calcium and carbon dioxide (carbonate ion) removal there is an optimum for the amount of CO2 sorbed in the carbonator. There is also an optimum amount of secondary raw sea water for the magnesium hydroxide precipitation. Use of evaporator blowdown for secondary water is not feasible unless calcium sulfate precipitation in the magnesium hydroxide precipitator can be eliminated by optimizing process flow rates or compensated for in downstream vessels. The lime split between the calcium carbonate precipitation train and magnesium hydroxide precipitator has an optimum value. Vapor-liquid-solid mass transfer rates and various equipment designs should be examined to determine the potential of this process modification. A computational technique was devised that allows for a realistic investigation of process alternatives and processing condition changes such as flow rates and solids loadings.
W79-04161

YOU NEVER MISS THE WATER ... TILL THE WELL RUNS DRY,
For primary bibliographic entry see Field 6D.
W79-04244

POWER GENERATION AND POTABLE WATER RECOVERY FROM SALINOUS WATER,
Universal Oil Products Co., Des Plaines, IL. (Assignee).
D. B. Carson.
U.S. Patent No. 4,121,977, 12 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1508, October 24, 1978.

Descriptors: *Patents, *Desalination processes, *Water purification, Potable water, Solar radiation, Separation techniques, Electric power production, Thermal powerplants, Condensation, Solar heat sink, Ocean thermal gradient.

A process for simultaneously generating power and recovering potable water from sea water is described. Salinous water, from close to the surface and at a relatively high temperature, is increased in temperature via indirect contact with a vaporous phase, derived from the surface water at an elevated temperature and a subatmospheric pressure. The preheated salinous water is exposed to radiant solar energy, in a solar radiation heat sink, to further increase the temperature. Thus-heated water is introduced into a first flash separation zone, maintained at subatmospheric pressure, to provide a first substantially non-salinous vaporous phase and a first salinous liquid phase. The first vaporous phase is passed into and through a turbine, from which power is generated. The first liquid phase is introduced into a second flash separation zone, maintained at a lower absolute pressure to provide a second salinous liquid phase and a second substantially non-salinous vaporous phase. The latter is utilized to preheat the surface water. The second liquid phase is introduced into a third flash separation zone, maintained at a lower absolute pressure than the second flash zone, to provide a third salinous liquid phase and a third substantially non-salinous vaporous phase. Vapors exiting from the turbine and the third vaporous phase are cooled and/or condensed via indirect contact from sea water obtained from a depth substantially lower than the surface and at a comparatively lower temperature to recover liquid potable water. (Sinha-OEIS)
W79-04468

SEA WATER DESALINIZATION SYSTEM,
L. A. Vlasnik.
U.S. Patent No. 4,122,012, 5 p, 1 fig, 1 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1517, October 24, 1978.

Descriptors: *Patents, *Desalination, *Desalination apparatus, Sea water, Filtration, Ion-exchange, Barriers, Sands, Basins, Separation techniques, Flow separation, Guayule plant(Parthemium argentatum).

A system for the desalinization of sea water is provided, which includes a barrier buried to a depth below the low tide water level in a sandy beach, and a collector vault, or well, buried in the beach behind the barrier. The vault has an opening in its side for receiving water passing through the barrier. The barrier is filled with selected filter materials, and the sand in the area between the barrier and the vault is treated with a selected material. After a period of pumping, desalinated water will appear in the vault and may be pumped out of the vault. Whenever the water in the vault is pumped below a particular level, a new supply of desalinated water will flow in through the opening in its side from the barrier. It is believed that the filter materials contained in the barrier set up an ion-exchange reaction in the saline or brackish solution passing through the barrier, and this ion-exchange reactions causes a desalinated water separation, with the lighter desalinated water flowing above the heavier brine or brackish solution through the sand and into the opening in the vault. The heavier brine solution is dispersed in the sand or may be pumped to waste through an appropriate drainage system. The sap of the guayule plant (Parthenium argentatum) is placed in the sand between the barrier and the vault, and this sap reacts with residual compounds in the sea or brackish water after passing through the barrier to cause such heavier materials to gravitate down into the brine solution underlying the upper layer of desalinated water. (Sinha-OEIS)
W79-04472

TURBULENT TRANSPORT TO A ROTATING CYLINDER,
California Univ., Berkeley. Dept. of Mechanical Engineering.
J. T. Teng, and R. Greif.
Letters in Heat and Mass Transfer, Vol. 3, p 365-374, 1976. Pergamon Press. (California Water Resources Center Desalination Project) S-176.

Descriptors: *Turbulent flow, *Heat transfer, *Mass transfer, *Momentum transfer, Velocity, Temperature.

The turbulent flow about a rotating cylinder, in an otherwise quiescent fluid, is studied. Velocity and temperature distributions are obtained by solving the corresponding conservation equations. A modified mixing length, which includes the effect of centrifugal forces in terms of the Richardson number, is used. A comparison is made with experimental data over a range of Reynolds numbers from 16,000 to 72,000. (Snyder-Calif Davis)
W79-04486

3B. Water Yield Improvement

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, SUMMARY REPORT.
Big Muddy River Basin Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04143

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, VOL. 7, APPENDIX M AND N.
Big Muddy River Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04144

PRECIPITATION MANAGEMENT AND THE ENVIRONMENT, AN OVERVIEW OF THE SKYWATER IX CONFERENCE.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2B.
W79-04157

BLASTING-IT TURNS DRY HOLES INTO WET ONES,
Universal Oil Products, St. Paul, MN. Johnson Div.
For primary bibliographic entry see Field 8A.
W79-04251

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

3C. Use Of Water Of Impaired Quality

WELLS AND PONDS: WATER QUALITY AND SUPPLY,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
E. C. Dickey, and W. D. Lembke.
Bulletin 758, Agricultural Experiment Station, University of Illinois at Urbana-Champaign, July 1978. 37 p, 13 fig, 4 tab, 47 ref, 1 append.

Descriptors: *Water wells, *Ponds, *Water supply, *Water quality, *Illinois, On-site data collections, Laboratory tests, Chemical analysis, Nitrates, Ammonia, Chlorides, Biochemical oxygen demand, Potassium, Phosphorus, Nitrogen, Dissolved oxygen, Groundwater, Wells, Farm ponds, Stock water, Potable water, *Washington County(IL), *Pope County(IL).

In a broad geographic band immediately south of the central Corn Belt, water supplies for domestic use and livestock are beset with problems. The flow of groundwater into shallow dug wells tends to be unreliable during dry seasons, and the flow rate through compact soils is at best only moderate to low at all times. In addition, the nitrate-nitrogen content in nearly 3/4 of the shallow wells in a representative county exceeded the U.S. Public Health Service standard, in some cases by tenfold. In contrast, 72 farm ponds sampled for nitrate-nitrogen were well below the standard of 10 milligrams per liter. Preliminary findings in Washington County, Illinois, in 1970 led to the research reported here, which is part of a larger study of nitrogen in the environment. The first section of this bulletin advanced a theory to explain excessive nitrate concentrations in some farmstead wells. The second section focused on nitrogen regimes in 15 farm ponds and one lake. It was assumed at the outset that little can be done in the short run to reduce the amount of nitrates in farm wells. For this reason ponds were studied as possible alternative sources for drinking water. An economic analysis showed that well-water systems in use in Washington County are the least costly available, but that water quality and quantity are for the most part undependable. Alternatives include farm ponds, municipal water supplies, transported water, and various combinations of these sources. Farm ponds with a purification system could be one of the more satisfactory alternative sources provided that water storage facilities are available for prolonged droughts. (Sims-ISWS)
W79-04068

SOIL-WARMING FOR WASTE HEAT DISPOSAL, CROP GROWTH ENHANCEMENT AND WASTE WATER RENOVATION,
The Pennsylvania State Univ., University Park, PA. School of Forest Resources.
D. R. DeWalle, D. D. Fritton, L. T. Kardos, D. P. Knievel, and J. M. Norman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 902, Price codes: A12 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources, Pennsylvania State University, Final Technical Report, December 1978. 267 p, 59 fig, 53 tab, 122 ref. OWRT C-6249(No. 5222)(4). 14-31-0001-5222.

Descriptors: *Evapotranspiration, *Soil temperature, *Sewage effluents, *Irrigation, Crop production, Alfalfa, Orchardgrass, Sudangrass, Water reuse, *Municipal wastewater.

To examine feasibility of utilization and dissipation of reject heat from power production, year-round soil-warming effects on subsurface and surface heat exchange, crop growth/development and renovation of municipal waste water were determined in central Pennsylvania. The soil in a 0.09 ha test plot was artificially heated by circulating water heated to 38C through a buried, parallel pipe network. Both the heated plot and an adjacent unheated control area were irrigated weekly with 1.5 cm municipal sewage effluent. Measurements of soil heat flow, pipe heat loss, soil temperatures, pipe temperatures, and soil thermal conductivity tested theoretical steady-state models describing heat loss from a buried pipe network. The fraction of pipe heat loss dissipated by evapotranspiration was determined through weighing microlysimeters. A horizontal atmospheric advection model scaled the small plot heat loss data to a full-sized area. Crop research focused on warm soil effects on winter survival, maturation, development, yield, quality and pest relationships for alfalfa, orchardgrass, tall fescue, winter wheat, winter barley, snapbeans and sudangrass. Crop research included a greenhouse study of soil temperature and compaction effects on root growth of tall fescue. The influence of the warm soil on the chemical composition of the applied sewage effluent was determined from samples periodically collected with suction lysimeters and analyzed for pH, NO3-N, organic-N, Cl-, total soluble salts and soluble orthophosphate.
W79-04080

ECONOMIC ANALYSIS OF THE CONJUNCTIVE USE OF SURFACE WATER AND GROUND WATER OF DIFFERING PRICES AND QUALITIES: A COMING PROBLEM FOR ARIZONA AGRICULTURE,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 6B.
W79-04104

GROUND-HEAT-ASSISTED HEAT PUMPS,
For primary bibliographic entry see Field 8C.
W79-04243

GEOTHERMAL GOES EAST,
P. Britton.
Popular Science, Vol. 214, No. 2, p 66-69, February 1979. 5 fig.

Descriptors: *Geothermal studies, *Eastern United States, *Geopressured brines, Methane, Natural gas, Atlantic coastal plain, Gulf coastal plain.

Recently, geologists have discovered potentially vast sources of low-temperature geothermal energy along the East Coast. The geothermal heat will be too cool for electrical generation but could be used for space heating, food processing, agriculture, and industry. The hot, pressurized saline water along the Gulf Coast is another potential geothermal resource. Methane can be extracted from it and electricity could be generated with the use of a turbine and heat exchanger. The brine would be reinjected into the earth. Engineering, environmental and institutional barriers to the development of geopressured resources are discussed. (Purdin-NWWA)
W79-04248

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

3D. Conservation In Domestic and Municipal Use

A CROSS-SECTIONAL INVESTIGATION OF THE DETERMINANTS OF URBAN RESIDENTIAL WATER DEMAND IN THE UNITED STATES, 1960 AND 1970,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 6D.
W79-04003

SOCIAL ASPECTS OF URBAN WATER CONSERVATION: A REVIEW OF THE 1971-72 FIELD STUDY,
Century Research Corp., Arlington, VA.
H. E. Abbott, Jr.
In: Proceedings, North Carolina Conference on Water Conservation, September 3-4, 1975. p 6-18, 2 fig. (1975) Water Resources Research Institute, North Carolina State University, Raleigh, J. M. Stewart, Editor. OWRT-C-2134 (No. 3401) (2). 14-31-0001-3401.

Descriptors: *Water shortage, *Water conservation, *Social aspects, Attitudes, Costs, Water utilization, Water supply, Water users, Surveys, Investigations, Regulation, Urban sociology, Domestic water, Reasonable use.

A literature review, conferences with government officials, correspondence with municipal officials, and interviews with producers and consumers of domestic water were used to determine socially acceptable strategies which would effectively conserve domestic water during emergency shortages, and to learn about consumer knowledge of water topics and attitudes towards conservation and regulation. A total of 18 communities was investigated. It was generally concluded that most users are ignorant of their water supply and tend to take it for granted. Most are willing to save water, but don't know how. In order to assure an adequate supply, people are willing to pay more than they do now for water. Radio, newspaper and television are the most effective means of informing people of the need to save water. Although voluntary conservation is usually effective, officials should be prepared to institute legal restrictions. (Davison-IPA)
W79-04094

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

3E. Conservation In Industry

PERSPECTIVES ON DESERTIFICATION,
New South Wales Univ., Kensington (Australia).
For primary bibliographic entry see Field 3F.
W79-04282

WASHING OF UNBLEACHED KRAFT PULP WITH EFFLUENTS (PROMYVKA SUL'FATNOI NEBELENOI TSELLYULOZY STOCHNYMI VODAMI),
Sibirskii Nauchno-Issledovatel'skii Inst. Tsellyulozy i Kartona (USSR).
G. E. Danilov, N. V. Ogorodnikova, and A. V. Boiko.
Bumazhnaya Promyshlennost', No. 7, p 16-17, July, 1978. 1 fig, 3 tab.

Descriptors: *Pulp wastes, *Water reuse, *Water conservation, Recycling, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Water pollution control, Foreign countries, Laboratory tests, Kraft pulp, Soviet Union(USSR), Black liquor, Condensates, Kraft mills, Board mills, Wash water, Industrial water.

In laboratory experiments at the Siberian Pulp and Board Research Institute, kraft pulp was washed by a process modeling the 8-stage washing process at the Selenga (USSR) mill, namely, with the mill's biologically and chemically purified pulping effluent and with black liquid evaporator condensate. Control experiments were carried out with fresh water. The washing effectiveness was the same as for fresh water washing. The strength of the pulp and of board made from the pulp was lowered slightly, but still within standard requirements. (Stapinski-IPC)
W79-04423

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

3F. Conservation In Agriculture

OBTAINING SPECIFICATIONS FOR MINIMUM COST IRRIGATION SYSTEMS,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6A.
W79-04012

SOIL-WARMING FOR WASTE HEAT DISPOSAL, CROP GROWTH ENHANCEMENT AND WASTE WATER RENOVATION,
The Pennsylvania State Univ., University Park, PA. School of Forest Resources.
For primary bibliographic entry see Field 3C.
W79-04080

A RATIONAL APPROACH FOR OPTIMIZING APPLICATION RATES OF FERTILIZER NITROGEN TO REDUCE POTENTIAL NITRATE POLLUTION OF NATURAL WATERS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 5B.
W79-04162

AGRICULTURE AND CONSERVATION--ECOLOGICAL AND SOCIAL ASPECTS,
U. Hampicke.
Agriculture and Environment, Vol. 4, No. 1, p 25-42, April, 1978. 70 ref.

Descriptors: Agriculture, Ecology, Social aspects, Political aspects, Pesticides, Planning, Economic impact, *Water conservation, Europe.

The technological features and the economic and political repercussions were discussed of an agricultural system which would meet strict conservation requirements in central Europe, should they exist. The rate and number of species losses, classification of endangered species and destruction of environmental variety were discussed. It was suggeted that the countryside be divided systematically into areas of high productivity, and others where traditional methods of land use are continued. Three possibilities for protecting ecologically valuable regions were discussed: abolishing the use of pesticides, etc. altogether; improved methods of crop spraying to prevent spray falling onto adjacent areas; and adaptation to unavoidable spray scattering by spatial structuring, i.e., installing bufffer areas between productive and protected zones. With regard to the political and economic consequences of such a system, three indispensable prerequisites were indentified: an adequate system of value judgments in society; sufficient economic flexibility to allow changes; and proper means of coordination, i.e., economic planning. It was concluded that gradual improvements on a local scale are possible and should be encouraged. (Skogerboe-Colorado State)
W79-04164

TENSIOMETERS TEACH HOW TO SAVE FUEL AND WATER,
N. Rodgers.
Irrigation Age, Vol. 12, No. 4, p 45-46, January, 1978.

Descriptors: *Tensiometers, Equipment, Data collections, Irrigation, *Irrigation efficiency, Soil moisture, Moisture tension, Moisture content, Water conservation.

Tensiometers are valuable tools for the irrigator helping him to save money and water during the irrigation season. The irrigation schedule, based on soil moisture tension, can be varied during different periods of the growing season, depending upon the water requirements of the plant. However, they can mislead the irrigator if the tensiometers are not properly placed and maintained. Reading tensiometers daily has been suggested since it will indicate the danger of the tensiometers breaking suction and thus taking false readings can be avoided. (Skogerboe-Colorado State)
W79-04165

NEW MEXICO PUMP STUDY POINTS TO FARMERS' NEED FOR EFFICIENCY KNOWLEDGE.
Irrigation Age, Vol. 12, No. 4, p 34-35, 58, January, 1978. 3 tab.

Descriptors: *Pump testing, *Pumps, *Irrigation efficiency, Natural gas, Irrigation Operation and Maintenance, New Mexico.

A New Mexico irrigation pump study suggestes farmers should know more about pump efficiency and should have expert help in selecting pumps. Overall efficiency of a pumping plant, according to the report, should range from 15 to 20%. A study conducted by Texas Techn College which covered power requirements and efficiencies of 46 natural gas pumps revealed that only six pumps exceeded 15% overall efficiency while 16 had overall efficiencies below 10% and the average was 10.7%. The study conducted in New Mexico suggeted that the average pump efficiency could be improved to 15% and thereby about 1.4 million cubic feet of natural gas used for irrigation pumping during an average year in New Mexico could be saved. This report also provides some guidelines for studying pumping plant efficiency. (Skogerboe-Colorado State)
W79-04166

STUBBLE BURN SCORES.
Irrigation Age, Vol. 12, No. 4, p 16, January, 1978.

Descriptors: *Burning, Infiltration rates, Crop production, Stubble, Costs, Irrigation efficiency.

A study conducted at Texas A and M Unversity compared plots where the straw was worked, where it was removed by bailing where the straw and stubble was burnt off. The results showed that the difference in yields from he three types of plots was statistically insignificant. But the calculated annual savings from burning off each year rather than bailing or working back into the soil was $4.02/acre; whereas burning every other year and every third year could save $2.01 and $1.34/acre respectively. Another study involving infiltration rates showed that the infiltration rate for the burnt area was slower in the first hour, but increased later during a 22-hour period. Total infiltration for the period for the plot with straw worked in was 2.58 inches compared with 2.50 for straw removed and 2.28 inches for the burned area. The effect of straw disposal treatments on soil struction including changes in soil aggregates, bulk density, organic matter and compaction was stuied. Results of dry and wet sieve analyses showed no significant differences among the three treatments. (Skogerboe-Colrado State)
W79-04167

'NO ROOM FOR ERROR' SAY YOUNG IRRIGATOR.
Irrigation Age, Vol. 12, No. 5, p 77, February, 1978.

Descriptors: *Crop production, Idaho, Potatoes, Fertilizers, Herbicides, Pesticides.

The total management approach towards agricultural crop production of a Idaho farmer was discussed. The approach includes frequent soil and plant testing, selection of good seed varieties, timely applications of fertilizers, herbicides, and pesticides of the right king and amount including a good crop rotation program. (Skogerboe-Colorado State)
W79-04168

NEW FLUME BREAKTHROUGH FOR DITCH IRRIGATORS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
A. J. Clemmens, and J. A. Replogle.
Irrigation Age, Vol. 12, No. 7, p 82-88, April, 1978. 3 fig, 3 tab.

Descriptors: *Flumes, *Irrigation ditches, Open channel flow, Flow measurement, Costs, Arizona.

New design methods for critical-flow flumes installed in open channels make on-farm flow measurement simple, accurate, and inexpensive. This paper describes the methods and construction procedures used in developing a new flume to measure water flow in open channels. The cost analysis of the eight flumes tested shows that the cost of the flume is very inexpensive compared with other types of flumes. It also claims to be precise within plus or minus 2%. (Skogerboe-Colorado State)
W79-04169

TAILWATER PITS GAIN POPULARITY IN TEXAS,
J. Blair.
Irrigation Age, Vol. 12, No. 7, p 70-71, April, 1978. 4 fig.

Descriptors: *Tailwater, Silts, Water conservation, *Irrigation practices, Crop production, Equipment.

Tailwater pits are one of the best methods yet divised to save irrigation water on the hardlands of northwest Texas and eastern New Mexico. Interest in them is still high, though the construction rate has slowed because of rising costs and the increase in sprinkle systems. In the recent years tailwater pits are designed according to the size of the field and amount of expected runoff with efficient silt traps. The reprot also suggests to check pump and motor occasionally to increase their refficiencies. It also suggests to irrigate alternate rows, learn when the crops go through stress periods, use limited tillage to reduce evaporation, improve tillage to reduce fuel costs, grow crops that use less water, and go back to terracing the fields if necessary. (Skogerboe-Colorado State)
W79-04170

BASIC IRRIGATION SCHEDULING PROCEDURES,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
P. E. Fischbach.
Irrigation Age, Vol. 12, No. 7, p 66-67, April, 1978. 2 fig.

Descriptors: *Irrigation efficiency, Irrigation water, *Scheduling, Soil moisture, Moisture content, Growth stages, Sweet corn, Moisture meters, Evapotranspiration, Water conservation.

On a fine textures deep soil, four basic irrigation scheduling procedures were compared on corn. The procedures consisted of irrigations according to (1) the calculated crop water use, (2) the average electrical resistance block reaching, (3) the soil moisture content (feel method) at three stages of growth of the corn plant, and (4) a predetermined range of net water application every 14 days. The difference between grain corn yields were not significant at the 5 percent level between scheduling procedures. The least effort to schedule irrigations was with the electrical resistance blocks. Appling only 2 inches of net irrigation water or less each irrigation is important so that nitrogen, water or energy is not wasted. Using a water measuring meter to know how much water was applied appears to be the most critical measurement to save nitrogen, water and energy. (Skogerboe-Colorado State)
W79-04171

EFFECT OF SALINITY ON AGRICULTURE IN IRAQ,
Mosul Univ. (Iraq). Coll. of Engineering.
M. A. Al-Layla.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR2, p 195-207, June, 1978. 2 fig, 3 tab, 3 ref, 1 append.

Descriptors: *Salinity, Agriculture, *Irrigation effects, *Return flow, Drainage water, Iraq.

Irrigation has progressed considerably in Iraq, but it has resulted in soil salinity thereby reducing the productivity of the agricultural lands. Land has been reclaimed by taking up drainage projects, but the discharge of the drainage water into the river has considerably increased the salinity of the river water causing deteriation in its quality. The increase in salinity of river water creates problems for irrigation and municipal uses, and therefore, the discharge of drainage water to the river must be controlled. To obtain maximum benefit from the use of land water resources, the problems of irrigation, drainage, control of river water quality, and education of farmers must be tackled as a whole and not in parts. (Skogerboe-Colorado State)
W79-04173

EFFECT OF IRRIGATION REGIME ON MAIZE YIELDS,
Colorado State Univ., Fort Collins. Dept. of Agriculture and Chemical Engineering.
J. W. H. Barrett, and G. V. Skogerboe.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR2, p 179-194, June, 1978. 9 fig, 2 tab, 20 ref, 1 append.

Descriptors: Yield equations, Sweet corn, *Crop response, Moisture stress, Growth stages, Evapotranspiration, Crop production, *Irrigation efficiency, Water conservation.

To determine the economically optimal allocation of irrigation water to a given crop, the relationship between the yield of the crop and its use of the supplied water must be known. Different shapes of the function relating yield to water use have been obtained by various researches. The strongly linear relationship between wheat grain yield and precipitation, has been supported by container and field experiments that have demonstrated from any crops a linear relationship between yield and water use until maximum yield is obtained. The purpose of this paper is to present field evidence substantiating the form of the crop yield-water use function and to demonstrate the effects of different irrigtion regimes on the yield of corn. (Skogerboe-Colorado State)
W79-04174

IRRIGATION MANAGEMENT SERVICE AND MOSQUITO CONTROL,
Colorado State Univ., Fort Collins. Center for Disease Control.
R. O. Hayes, and R. L. Nielsen.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR2, p 153-163, June, 1978. 1 fig, 2 tab, 19 ref, 1 append.

Descriptors: *Irrigation programs, *Mosquitoes, Irrigation practices, Vectors(Biological), Diseases, Crop production, Irrigated land.

The importance of irrigation to the production of agricultural crops has led to its widespread use throughout the United States. Mosquito production and vector-borne diseases often have been problems in intensely irrigated areas, but in some areas good irrigation water management practices have been shown to mimimize such problems. The evaluation of the Mesa County, Colorado, Irrigation Management Service (IMS) program found it associated with lower site and habitat infestation rates only among the IMS orchard sites, whereas the IMS program was not associated with reduced mosquito production among either alfalfa or corn fields, and no mosquito production was found associated with sugar beet crops, either in or out of the IMS program. Although pastures were not included in the IMS program, they were included in this evaluation, and a high percentage of the pastures examined were associated with mosquito production. The results also revealed that the mosquito fauna, the principal types of mosquito larval habitats, and the water sources for mosquito breeding in the irrigated areas of Mesa County were nearly the same in 1975 as in 1959. (Skogerboe-Colorado State)
W79-04175

NONUNIFORM SPRINKLER IRRIGATION APPLICATION EFFICIENCY,
Sao Paulo Univ. (Brazil). Dept. of Hydraulics and Sanitary Engineering.
F. H. Chaudhry.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR2, p 165-178, June 1978. 4 fig, 15 ref, 43 equ, 3 append.

Descriptors: *Irrigation efficiency, *Sprinkler irrigation, Uniformity coefficient, Distribution, Statistical methods.

Application efficiency offers a physically significant characterization of nonuniform irrigation which can help in striking a balance between the cost of maintaining higher uniformity and the cost of water. This paper quantifies the role of asymmetry in the various efficiency parameters of nonuniform irrigation representing its areal pattern by a skew distribution. It is shown that if the application ratio or the coefficient of variation, or both, are small, the application efficiency approaches the value of the application ratio. The equality between the application ratio and the application efficiency can be obtained at relatively larger coefficients of variation (or smaller uniformity coefficients) for positively skewed distributions. Given the statistical properties of the sprinkler or surface irrigation distribution and the proposed application ratio, the results of this study should permit a more accurate evaluation of the application efficiency and thus of the economics of the proposed installations. (Skogerboe-Colorado State)
W79-04176

ON-FARM LEVEL-BASIN IRRIGATION--SAVE WATER AND ENERGY,
Agricultural Research Service, Phoenix, AZ.
A. R. Dedrick, J. A. Replogle, and L. J. Erie.
Civil Engineering, Vol. 48, No. 1, p 60-65, January, 1978. 8 fig.

Descriptors: *Surface irrigation, Basins, *Irrigation efficiency, Irrigation systems, Irrigation practices, Water conservation, Automation.

Spiraling energy costs, and the doubtful availability of electricity or natural gas for pumping, stand as a serious threat to future high-energy-consuming water application techniques. Even with the growing concern for water conservation, we may run out of energy before we run out of water. Surface irrigation, because of its lower energy requirements, deserve renewed attention. Thus, despite the merits of its lower energy requirements, deserve renewed attention. Thus, despite the merits of sprinkler and trickle irrigation, conversion from surface irrigation should be approached cautiously, especially where properly designed surface irrigation techniques are suitable. Uniformity of application and resultant minimal water loss over the irrigated area are prime criteria of an irrigation system. These can be attained with level basins by balancing the basin size to the irrigation water supply and soil intake characteristics. The key factors in boosting irrigation efficiencies are suggested as : (1) using lasers to make the farm field as level as possible, (2) using special flumes and weirs to measure water flow, and (3) using automated

gates to control the amount of water applied to a field. (Skogerboe-Colorado State)
W79-04177

DISTRIBUTION PATTERNS AND LOSSES FOR FURROW IRRIGATION,
Colorado State Univ., Fort Collins. Dept. of Agriculture and Chemical Engineering.
D. Karmeli.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IRI, p 59-68, March, 1978. 4 fig, 1 fig, 10 ref, 22 equ, 1 append.

Descriptors: *Furrow irrigation, Surface irrigation, Distribution patterns, *Irrigation efficiency, Model studies, Mathematical models, Recession curves, Infiltration.

A model was developed to describe the distribution patterns and efficiencies for furrow irrigation. The model consisted of the following: (1) A frequency curve of the dimensionless infiltration depth (actual infiltered depth/desired infiltration depth), versus fractional length of run (distance from end of field/total length of field); (2) Description of the frequency curve by a mathematical model that enables the comparison of systems by using the model to establish the various efficiencies and other statistical parameters such as the deviation from desired application depth. The model, based on the power curve fit for surface irrigation systems, was found to be a good representation of actual patterns of distribution in an irrigated field. The model suggested allows for integration of the various functions related to irrigation performance such as water-yield function. (Skogerboe-Colorado State)
W79-04181

DESCRIBING IRRIGATION EFFICIENCY AND UNIFORMITY,
American Society of Civil Engineers, New York.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR1, p. 35-41, March, 1978. 3 fig, 11 ref, 6 equ, 1 append. On-Farm Irrigation Committee of the Irrigation and Drainage Div.

Descriptors: *Irrigation efficiency, Uniformity coefficient, *Standards, Irrigation, Soil moisture, Efficiencies.

There is an urgent need for standardization of efficiency terms used in on-farm irrigation. The purpose of this paper is to provide meanings for several such terms to reduce the vagueness and resulting confusion that now exists. The committee hopes these definitions will be accepted as standards, thus reducing conflicting usage and the consequent need for redefinition each time such terms are used. Only terms applicable to on-farm irrigation practices are presented, although many may be usable for larger units such as irrigation districts or basin wide projects. (Skogerboe-Colorado State)
W79-04183

FLOAT VALVES IMPROVE PIPELINE SYSTEMS,
Science and Education Administration, Kimberly, ID. Agricultural Engineering Div.
A. Humphreys.
Irrigation Age, Vol. 12, No. 7, p 12-15, April, 1978. 1 fig, 1 tab.

Descriptors: Water conservation, *Valves, Flow control, Water shortage, *Irrigation efficiency, Costs.

Water shortages and rising energy and labor costs are forcing irrigators to look for ways to increase irrigation efficiency and reduce operating costs. To accomplish this, they need maximum system flexibility and ease of operation. Many low pressure pipeline systems can be improved by using float valves to provide better and easier water control. Float valves are relatively new and since most of them are used in California where they were developed, many farmers are not familiar with them. This paper discusses the applicability of float valves in various situations of field irrigation systems. (Skogerboe-Colorado State)
W79-04184

HOW IDAHO IRRIGATORS TRIM BACK POWER COSTS,
C. Henry.
Irrigation Age, Vol. 12, No. 8, p 82-84, May-June, 1978.

Descriptors: Scheduling, *Irrigation practices, Electric power costs, Fertilizers, Water conservation, Crop production, Idaho, *Costs.

This article reports the benefits obtained by a Idaho farmer by irrigation scheduling. Irrigation scheduling has not only helped to keep the power cost down but also it has reduced labor-hour requirement, leaching of fertilizers and has resulted in increased yields. One other additional advantage was in management operations, such as thinning and cultivations, during periods indicated by favorable moisture content. (Skogerboe-Colorado State)
W79-04186

LIMITED IRRIGATION TESTS GET RESULTS,
R. Larsen.
Irrigation Age, Vol. 12, No. 8, p 72-74, May-June, 1978. 2 fig.

Descriptors: Water conservation, Moisture deficit, Growth stages, Timing, *Irrigation practices, Corn(Field), Sorghum, Soybeans, Kansas, Nebraska.

Limited irrigation experiments were conducted in Kansas and Nebraska on corn, sorghum and soybean. It was observed by the researchers in the two states that corn yield was reduced by limiting irrigation at any stage of growth but a single irrigation was most effective just before the silking stage. With soybean, they observed that the most critical period was at the beginning of pod development, whereas with sorghum, the timing of irrigation was not found to be important which gives it a management advantage when using limited water. The experiments showed that the limited irrigation techniques help in saving water, energy and irrigation equipment wear and tear. (Skogerboe-Colorado State)
W79-04187

IRRIGATE--A SCHEDULING MODEL,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
P. Tscheschke, J. R. Gilley, T. Thompson, and P. Fischbach.
Agricultural Engineering, Vol. 59, No. 1, p. 45-46, January, 1978. 1 fig, 4 ref.

Descriptors: Water conservation, Scheduling, Irrigation, *Computer models, Computer programs, Timing, Evapotranspiration, Climatic data, *Irrigation systems.

Irrigation is a major consumer of the three scarce commodities: energy, water, fertilizer. The need for conservation through good irrigation management practices is urgent. To help meet these needs, University of Nebraska has developed an irrigation scheduling program called IRRIGATE for its AGNET (Agricultural Computer Network)system. The network serves the Institute of Agriculture and Natural Resources at the University of Nebraska-Lincoln and benefits the agricultural community directly. As with all AGNET models, IRRIGATE is designed for teaching, research and extension work. Access to AGNET can be made through small portable computer terminals. These are priced from $2000 and are about the size and shape of a portable typewriter. IRRIGATE records a field's soil moisture status since planting and answers the important questions of when and how much water should be applied in future irrigations. IRRIGATE is designed to be user oriented. IRRIGATE can be used with a wide variety of irrigation systems, with nine commonly grown area crops, with eight common soil types and with a minimum of climatic data (maximum and minimum temperature only) if necessary. The irrigation scheduling for about 25,000 acres was handled through IRRIGATE and AGNET in 1977. (Skogerboe-Colorado State)
W79-04188

BETTER WATER USE, SAY TEXANS,
J. Blair.
Irrigation Age, Vol. 12, No. 6, p 26, March 1978.

Descriptors: Water conservation, Irrigation wells, Texas, *Irrigation efficiency, Grain sorghum, Cotton, Drought resistance, Surface irrigation, Sprinkler irrigation.

Irrigation on the Southern High Plains will continue the trends started a few years ago when production costs escalated. There will be greater emphasis on irrigation efficiency, more timely watering, fewer irrigations, and a slow-down in buying of new equipment. Also there will be a shift in crop acreages, with some of the corn and wheat land being in milo and cotton. Consensus of opinion of the farmers is that despite higher irrigation costs most farmers will pump the wells in 1978. But there will be continued improvement in pumping efficiency, more water conservation methods used, more dependence on rainfall and a shift to drought resistant crops, such as cotton and grain sorghum. (Skogerboe-Colorado State)
W79-04191

DRIP AND/OR SPRINKLER,
Olson Engineering Systems, Indio, CA.
B. R. Olson, Jr.
Irrigation Journal, Vol. 28, No. 3, p 46-47, May-June, 1978.

Descriptors: Water conservation, Irrigation systems, *Sprinkler irrigation, Irrigation water, Filtration, *Drip irrigation.

The purpose of this report is to discuss the various aspects of drip irrigation system associated with its applicability and how it compares with sprinkler irrigation system. (Skogerboe-Colorado State)
W79-04192

DEVELOPMENT OF AGRICULTURAL IRRIGATION IN THE FEDERAL REPUBLIC OF GERMANY,
Federal Ministry of Food, Agriculture and Forestry, Bonn (Germany, F.R.).
K. Zanker.
ICID Bulletin, Vol. 27, No. 1, p.85-88, January, 1978. 3 tab, 4 ref.

Descriptors: *Irrigation systems, *Sprinkler irrigation, Water conservation, Water shortage, Germany.

Although the Federal Republic of Germany is situated in the temperate zone and owing to its quite high rainfall has no real water shortage in the strict sense of the term, modern irrigation methods do however offer the possibility of using the available water supply more rationally and more economically. This is particularly true for years with low rainfall. In granting new water rights, the authorities should strive to reserve the supply of ground water primarily for drinking purposes. In most cases for irrigation, surface water or effluent is sufficient (the latter of course subject to standards of hygiene being met). The results of the present paper can be usefully applied to areas where a real water shortage exists-arid and semi-arid zones of the earth. The more economical use of water available, made possible by more modern irrigation methods, which can lead to a considerable saving of water, can be of great importance, especially when water is in particularly short supply. (Skogerboe-Colorado State)
W79-04194

DRAINAGE AND THE CENTER PIVOT SPRINKLER METHOD OF IRRIGATION,

almont International, Valley, NE.
A. Alvi.
ID Bulletin, Vol. 27, No. 1, p. 76-78, January, 78. 7 ref.

escriptors: *Sprinkler irrigation, Drainage, Flood igation, Salinity.

e surface method of flood irrigation is a source drainage problems and it also does not provide ntrolled amounts of water to crops as and when quired. The Center Pivot Sprinkler method of igation helps to solve these problems and has ne other additional advantages. This method of igation in combination with integrated drainage nstruction is hoped to meet growing needs of od and fiber for the increasing world population. kogerboe-Colorado State)
79-04195

RIP IRRIGATION-CHEMICAL, PHYSICAL AYS TO KEEP EMITTERS OPEN,
ops and Soils Magazine, Vol. 30, No. 6, p 15-18, rch, 1978. 9 fig.

escriptors: Maintenance, Clogging, *Irrigation tems, Water conservation, Chemical precipitan, *Drip irrigation.

e most serious problem in drip irrigation is gging of emitters caused by chemical or biologi- buildup in minute water passageways. Prevent- that buildup is a key to successfully operating st drip irrigation systems. Researchers at Yuma l Phoenix, Arizona approached the clogging oblem and reclaimed old drip lines by adding ute H2SO4 and hypochlorite solution (laundry ach) to the irrigation water entering the lines. er the initial 'slug' treatment, the emitters were erating at 95% of the designed flow. After the to 36-hour treatment, the entire system was ated with lower concentrations of chlorine and d, keeping the system at about 1 ppm chlorine l a pH of 7. That continuous treatment mained satisfactory emitter performance, not only in older lines but in a newly installed system. re research is being done to expand guidelines maintaining emitter performance. (Skogerboelorado State)
9-04196

MPUTER SCHEDULING CAN SAVE MORE ATER,
gation Age, Vol. 12, No. 6, p 17, March, 1978.

scriptors: Irrigation programs, Scheduling, *Irtion efficiency, *Water conservation, Computnodels, Computer programs, Nebraska, *Irriga- systems.

s reported that scheduling of irrigation water lication through the use of electrical resistance cks to determine soil moisture content, with a feedback to a computer system, can save up to % of the water and energy being used in most gation operations without reducing yields. One h irrigation scheduling computer program deoped at the University of Nebraska-Lincoln has n discussed in this report. (Skogerboe-Colorado te)
9-04198

DER-TREE IRRIGATION SYSTEM.
gation Journal, Vol. 28, No. 3, p 34, May-June, 8.

scriptors: Irrigation systems, *Sprinkler irriga-, Drainage, Leaching, Israel.

paper entitled 'Irrigation in the 21st Century-lay', which appeared in the May/June 1976 e of the Irrigation Journal, dealt with the adtages of the Micro Jet and referred to it as the gation system of the future. The purpose of this er is to describe an Israeli emitter, or minisikler which has been in operation for a number years and also shows a great potential for the ure. (Skogerboe-Colorado State)
9-04199

DRIP SYSTEMS STANDARDS AND SPECIFICATIONS.
Irrigation Journal, Vol. 28, No. 3, p. 12-13, 32, May-June, 1978.

Descriptors: *Drip irrigation, *Standards, Specifications, Irrigation systems, Irrigation design.

These standards and specifications of drip irrigation systems outlined by the Florida Irrigation Society contains useful information and guidelines for the irrigation industry. (Skogerboe-Colorado State)
W79-04200

STANDARDS FOR THE CALCULATION OF IRRIGATION EFFICIENCIES,
ICID Committee on 'Assembling Irrigation Efficiency Data'.
ICID Bulletin, Vol. 27, No. 1, p. 91-101, January, 1978. 6 tab, 6 equ.

Descriptors: *Standards, *Irrigation efficiency, Irrigation ditches, Irrigation canals, Irrigated land, Irrigation design.

The efficient management of irrigation water is becoming more important as the competition for water of good quality grows ever keener with the world's increasing population. Reliable measurements of water are vital in preventing wastage and in the attainment of maximum beneficial use. Measurements should be made and records kept of all water flowing into and through the supply system and of all deliveries made from the system. Discharge measurements should be made as accurately as is practicable and action should be taken to restrain overdelivery. The purpose of this paper is to lay down a standard procedure for assessing efficiency of water use in conveyance, distribution and field application operations. (Skogerboe-Colorado State)
W79-04201

TRANSIENT CHANGES IN THE SOIL-WATER SYSTEM FROM IRRIGATION WITH SALINE WATER: I. THEORY,
California Univ., Riverside. Dept. of Soil and Environmental Science.
For primary bibliographic entry see Field 2G.
W79-04202

TRANSIENT CHANGES IN THE SOIL-WATER SYSTEM FROM IRRIGATION WITH SALINE WATER: II. ANALYSIS OF EXPERIMENTAL DATA,
California Univ., Riverside. Dept. of Soil and Environmental Science.
For primary bibliographic entry see Field 2G.
W79-04205

PREDICTION OF PHOSPHORUS DIFFUSION FROM FERTILIZER SOURCE,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 2K.
W79-04208

DISPOSITION OF 15N-LABELED FERTILIZER NITRATE APPLIED DURING CORN CULTURE IN FIELD LYSIMETERS,
Science and Education Administration, Temple, TX. Grassland-Forage Research Center.
F. W. Chichester, and S. J. Smith.
Journal of Environmental Quality, Vol. 7, No. 2, p 227-233, April-June, 1978. 3 fig, 5 tab, 21 ref.

Descriptors: *Nitrates, Fertilizers, *Denitrification, Leachate, Runoff, Nitrogen cycle, Lysimeters, Sweet corn.

Calcium nitrate labeled with 5.5% 15N was applied at 336 kg/ha nitrogen (N) to each of two conventional tillage and two mulch minimum tillage field lysimeters continuously cropped to corn (Zea mays L.). Disposition of the labeled N was followed for 3 years, particularly relative to its effect on water quality. An accounting of applied 15N for the study period showed that <2% moved in runoff, approximately 30% was leached in percolate, 25 to 30% was recovered by the corn crop, and from 10 to 30% remained in the soil. On the basis of a balance sheet constructed from the data, 15N gaseous loss (presumably mainly by denitrification) was estimated to range from 6 to 26% of that applied. The magnitude of gaseous loss of N appeared to vary as a function of lysimeter management history, with the systems under improved soil fertility management exhibiting less gaseous loss due to greater immobilization of 15N in the soil organic fraction. (Skogerboe-Colorado State)
W79-04223

A KINEMATIC MODEL FOR SURFACE IRRIGATION,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2G.
W79-04230

INHIBITION OF UREASE ACTIVITY BY HETEROCYCLIC SULFUR COMPOUNDS,
Alberta Univ., Edmonton. Dept. of Soil Science.
For primary bibliographic entry see Field 2K.
W79-04233

RESIDUAL FERTILIZER NITROGEN IN A FLOODED RICE SOIL,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W79-04237

SODIUM BICARBONATE EXTRACTION TO ESTIMATE NITROGEN, PHOSPHORUS, AND POTASSIUM AVAILABILITY IN SOILS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Div. of Soil Chemistry and Plant Nutrition.
For primary bibliographic entry see Field 2G.
W79-04238

A TECHNIQUE FOR ASSESSING SEEDLING EMERGENCE UNDER DROUGHT STRESS,
Utah Agricultural Experiment Station, Logan.
D. A. Johnson, and K. H. Asay.
Crop Science, Vol. 18, p 520-522, May-June, 1978. 1 fig, 1 tab, 17 ref.

Descriptors: *Seedling emergence, *Germination, *Crop response, *Drought resistence, *Wheatgrasses, *Moisture stress, Genetics, Plant breeding, Planting management, Grasses.

Germination and emergence in low rainfall, drought stressed regions is a critical problem in the establishment of many crops. Accordingly, the development of a technique to determine seedling emergence under drought stress is described here as it was used in a plant breeding study to screen large seedling populations for emergence potential under drought stress. A modified Kaufman soil-solute germination technique is described that avoided direct seed and osmoticum contact, allowed for the maintenance of a wide range of soil water potentials and was capable of determining the emergence potential of a large number of seedlings. Application of the technique to 120 lines of crested wheat grass - Agropyron desertorum, A. cristatum, and A. sibiricum, indicated significant differences in seedling emergence at two water stress levels with the greatest genetic variance occurring under the most severe drought-stressing conditions. The difference among progenies, however, were not consistent under the two stress levels as indicated by a highly significant progeny X stress level interaction and a significant, but low, correlation (R=0.40) between drought stress levels. Although selection for seedling emergence would then be expected to produce different results under the two moisture stress levels, some progenies emerged well consistently under both treatments. Genetic improvement opportunities appear to be greatest under the more severe

drought stress treatment although it is suggested that selection be made under the range of moisture regimes to which the variety is most likely to be subjected. (Tickes-Arizona)
W79-04280

PERSPECTIVES ON DESERTIFICATION,
New South Wales Univ., Kensington (Australia).
J. A. Mabbutt.
Economic Geography, Vol. 53, No. 4, p 317-321, Oct. 1977. 12 ref.

Descriptors: *Dry farming, *Land management, *Land reclamation, *Desertification, *Political constraints, *Planning, Arid lands, Climatic zones, Land development, Land resources, Social effects, Water resources development, Water management(Applied), Productivity.

Various preceptions of the problem of desertification are reviewed here to illustrate the often conflicting views as to the potential and proper utilization of the worlds dry lands. For many, these water-stressed areas are considered inhospitable, infertile, and uncertain habitats which can be occupied and made productive only by adjustments which entail great physical, social, or economic costs to their inhabitants. On the other hand, there are those who content that dry lands have good potential and that their underproductivity cannot be tolerated in an increasingly hungry and demanding world. It is the author's contention that people tend to find the kind of evidence they seek and neither of the opposing views have so far been supported by careful estimates of the numbers of people that dry lands might safely support in the near future. Whatever course of action is followed, it is argued here that failure will result unless measures are made to relate to the problems as they are perceived by the local residents of the area in question. (Tickes-Arizona)
W79-04282

A WINNING BATTLE AGAINST DESTRUCTION,
Desert Inst., Ashkhabad (USSR).
A. G. Babaev, and N. S. Orlovsky.
Unesco Courier, p 17-22, July 1977. 4 fig.

Descriptors: *Project post-evaluation, *USSR, *Irrigation systems, *Canals, Project purposes, Alternate planning, Project benefits, Multiple-purpose projects, Research and development, Water conservation, Agricultural engineering, Structural design, Construction, Land management, Irrigation canals, Desalination plants, Water, Delivery.

Through research and development, the arid regions of the Soviet Union, covering two and one-half million sq. km., have become some of the most productive areas of the country. Settlement and intelligent grazing patterns have replaced traditional nomadic practices that once led to widespread destruction of potentially arid lands. The Golodnaya project, Yaskhansky pipeline, the Dzhezkazgan copper works, and the Shevchenko desalination project have transformed a once barren region covering millions of hectares into a diversified and productive agricultural region through construction of modern water delivery and treatment works. These projects are small, nevertheless, in comparison with the construction of world's largest desert irrigation project, the Karakum Canal. This ship-carrying canal, already responsible for half of the Turkmen SSR's crop of cotton, will eventually irrigate more than a million hectares. These projects, by reclaiming literally the whole of the Soviet Union's arid lands, have changed a once-harsh environment into a diverse and progressive region upon which the country has grown to depend. (Tickes-Arizona)
W79-04284

GROWTH AND YIELD OF JOJOBA PLANTS IN NATIVE STANDS USING RUNOFF-COLLECTING MICROCATCHMENTS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
W. L. Ehrler, D. H. Fink, and S. T. Mitchell.
Agronomy Journal, Vol. 70, p 1005-1009, Nov.-Dec., 1978. 6 fig, 1 tab, 13 ref.

Descriptors: *Water harvesting, *Runoff, *Surface sealing, *Jojoba, *Microcatchments, Arid climates, Rainfall-runoff relationships, Water conservation, Water yield, Xerophytes, Crop response, Soil-water-plant relationships, Soil moisture.

Water harvesting catchments were established around a marginal water-stressed stand of Jojoba in the Usery Mountains east of Phoenix, AZ., to improve plant growth and seed yield of a native Jojoba stand by using simple water-harvesting techniques to increase the available water and to better understand Jojoba-soil-water relationships. The 1-ha study site was divided into three treatment areas containing a total of 30 small indigenous female bushes. Rainfall, runoff, soil moisture, relative leaf water content, plant volume and seed yield were measured in each of the three treatment areas which included: (1) surface treatment with a water repellant coating, (2) clearing, smoothing and rolling, and (3) no water harvesting catchment or surface conditioning. Plant volume increased an average of 43, 44, and 237% for no treatment, cleared, smoothed and rolled, and water repellant coating areas respectively over a four year period. Plant seed yields increased 27, 26, and 208 g/plant for the respective treatments in 1977 although frost damage severely limited production in 1975 and 1976. It was concluded that this study demonstrated the feasibility of using simple water harvesting techniques to significantly increase Jojoba seed yield on native plant stands. (Tickes-Arizona)
W79-04288

LAND TENURE, HAZARDS, AND THE ECONOMY: VITICULTURE IN THE MENDOZA OASIS, ARGENTINA,
Valporaiso Univ., IN.
R. A. Hansis.
Economic Geography, Vol. 53, No. 4, p 368-371, Oct. 1977. 4 ref.

Descriptors: *Argentina, *History, *Risks, *Viticulture, *Land tenure, Economic feasibility, Economic impact, Arid lands, Land management, Land use, Melt water, Waterlogging, Water supplies, Water management(Applied), Water shortage, Saline soils.

The problems of desertification as exemplified by waterlogging of soils, salinization, uncertain rainfall, and variability of crop production is endemic throughout the arid world. This author has described the impact of these environmental factors on a small group of farmers in the arid Mendoza region of Argentina, tracing the increase in grape production there when mass migration from grape-growing regions of Europe took place at the turn of the century. Water in the area was and is the limiting factor, with only 150-200 mm annual precipitation. Meltwater from the Andes and other surface waters is distributed by an elaborate network of canals and ditches but even such a system cannot withstand fluctuations in prices superimposed on the physical problems of shortages of water and the degradation of the soil. These physical and economic hazards traditionally experienced by small subsistence farmers everywhere should alert the international umbrella organizations to the need for a deeper understanding of these problems and for recognition of the steps necessary to overcome them. (Tickes-Arizona)
W79-04291

EFFECTS OF PLANTING CONFIGURATION ON WATER USE AND ECONOMICS OF DRIP IRRIGATION SYSTEMS,
Central Arid Zone Research Inst. Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
S. D. Singh.
Agronomy Journal, Vol. 70, No. 6, p. 951-954, Nov.-Dec., 1978. 2 fig, 2 tab, 6 ref.

Descriptors: *Drip irrigation, *Irrigation design, *Irrigation efficiency, *Irrigation systems, *Cost analysis, Economic feasibility, Pipelines, Water distribution(Applied), Soil-water-plant relationships, Crop response, Irrigation effects, Irrigation engineering, India.

This study evaluates the effect of different planting configuration in crop performance, produce quality, and savings in the cost and in the amount of water used. Field experiments were conducted on a loamy soil in the arid region of Rajasthan, India. The treatments comprised four planting geometries: (1) 60cm. x 25cm. rectangular, (2) 25cm. square, (3) 18.75cm. hexagonal and (4) 25cm. equilateral, which were evaluated in separate experiments on four crops: cabbage, cauliflower, tomato, and turnip. The rectangular and hexagonal planting configurations resulted in single, double and triple row configurations and required 4, 2, and 1 drip lateral per 2.40 M plot width respectively. Results indicated that the yield and quality of produce was the same in both double and single row configuration, suggesting a possible 50% reduction in cost and water use. Cost and water use were reduced 75% with the hexagonal configuration but resulted in a 26-52% reduction in yields compared to the rectangular. Tomato was the one crop unaffected by hexagonal configuration, indicating that the cost and water use of tomato production can be cut in half with the proper drip irrigation design and planting configuration. (Tickes-Arizona)
W79-04302

WATER ECONOMY AND SALINE WATER USE BY DRIP IRRIGATION,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
S. D. Singh, J. P. Gupta, and P. Singh.
Agronomy Journal, Vol. 70, No. 6, p. 948-951, Nov.-Dec., 1978. 3 tab, 2 fig, 10 ref.

Descriptors: *Irrigation practices, *Irrigation efficiency, *Drip irrigation, *Soil-water-plant relationships, *Crop response, Furrow irrigation, Irrigation effects, Irrigation water, Evapotranspiration, Water requirements, Saline water, Rates of application, Water utilization, Soil water, Arid lands.

This study evaluated (1) the relationship between yield and amount of water applied by drip and furrow methods, (2) the potential of using poo quality water for the irrigation of vegetable crop by drip irrigation, and (3) distribution of water and salts in soil with drip irrigation. Field tests wer conducted during 1972-73 and 1973-74 on a loamy sand soil to analyze the effects of irrigation with sweet and saline waters applied by drip and furrow methods on the yield of potatoes. Experimenta drip irrigation treatments included: (1) drip irriga tion equal to ET, (2) equal to 75% of ET, (3) equa to 50% of ET, (4) with saline water equal to ET and (5) furrow irrigation equal to ET. Drip irriga tion at a rate equal to 1.0 ET was also evaluate with tomatoes. Results indicated that drip irriga tion at a rate less than ET decreased the yield o potatoes compared with the rate equal to ET, an required 50% less water than furrow irrigatio obtaining the same yields. Saline water of 3,00 mhos/cm. applied by drip irrigation caused n yield reduction but at 10,000 mhos/cm. a 919 reduction in potatoes and 35% reduction in toma toes was found. Soil water was found to be 15% beneath the emitter, 7% 20cm. from the latera and 3 to 4% near the wetting front 40cm. from th lateral. Salts were concentrated in the surface 15 t 20cm. midway between the emitters and towar the wetting front. (Tickes-Arizona)
W79-04303

VALUE OF DRIP IRRIGATION COMPARE WITH CONVENTIONAL IRRIGATION FO VEGETABLE PRODUCTION IN A HOT ARI CLIMATE,
Central Arid Zone Research Inst., Jodhpur (Indi Div. of Soil-Water-Plant Relationship Studies.
S. D. Singh, and P. Singh.
Agronomy Journal, Vol. 70, No. 6, p 945-94 Nov.-Dec., 1978. 1 fig, 2 tab, 9 ref.

Descriptors: *Drip irrigation, *Irrigation practic *Irrigation efficiency, *Soil-water-plant relatio ships, Irrigation operation, Maintenance, Irrigati

ign, Irrigation systems, Applied water distribu-
, Flood irrigation, Sprinkler irrigation, Furrow
gation, Water quality, Arid lands, Evapotran-
ation, Climatology, Vegetable crops, Timing.

s study evalutes drip, sprinkler, and furrow
gation methods with respect to yield and water-
efficiency, using the same rate of water appli-
on and the same mode of fertilizer application
with different irrigation frequencies. The test
os used in this analysis were long gourd, ridge
rd, watermelon and round gourd planted in a
ny sand with sand, silt and clay content at 85.2,
and 9.9% respectively. With drip and sprinkler
hods water was applied daily in amount equal
8% of the evaporation from a class A pan,
le furrow and overhead techniques commenced
n the cumulative total evapotranspiration
hed 3.2cm. The pattern of yield accumulation
he four crops under these three methods were
erent and the benefits of drip irrigation were
the same for all crops. Accumulation rates for
irrigated crops showed trends toward rapid
vth toward the end of the growing season and
gourd increased in yield by 45-47%, round
rd by 21-38% and watermelon by 10-22% com-
d with sprinkler and furrow techniques. Addi-
ally, water use efficiency with drip irrigation
nearly twice that of other techniques. It is
cluded that drip irrigation has the potential to
ease yield for most if not all vegetable crops.
kes-Arizona)
-04304

ESTABLISH A NATIONAL WATER
ICY.
primary bibliographic entry see Field 6E.
-04447

TION TIMING SELECTION CIRCUIT FOR
IGATION CONTROLLER,
nar Mfg. Corp., Azusa, CA. (Assignee).
. Ruggles.
Patent No. 4,121,114, 7 p, 2 fig, 2 ref; Official
ette of the United States Patent Office, Vol
No 3, p 1198, October 17, 1978.

criptors: *Patents, *Irrigation, *Irrigation prac-
, *Control systems, Sprinkler irrigation, Irriga-
efficiency, Remote control, Electronic equip-
t, Drip irrigation.

any applications there is a requirement for a
ure of short-term spray irrigation and long-
drip irrigation of shrubs, and it is highly
able to be able to selectively assign various
b irrigation valves as either spray or drip irri-
n stations. This invention is directed to these
. It is an improved irrigation controller in
h provision is made for selectively designating
ns for either short-term or long-term irriga-
The improvement includes an additional ca-
or connectable in parallel with the timing
citor of the system, and means for automati-
switching the capacitor into connecton with
iming capacitor for selected stations. (Sinha-
S)
-04462

ARY SPRAYING DEVICE PARTICULAR-
JSEFUL FOR WATER IRRIGATION,
)rori.
Patent No. 4,121,769, 9 p, 18 fig, 7 ref; Official
ette of the United States Patent Office, Vol.
No. 4, p 1442, October 24, 1978.

riptors: *Patents, *Irrigation, *Sprinkler irri-
n, Irrigation practices, Irrigation efficiency,
ication equipment, Nozzles.

tary liquid spraying device comprises a nozzle
a liquid spraying head rotatably mounted to
ozzle, the spraying head including an internal
ber having a shaped inlet orifice receiving the
om the nozzle, and a number of outlet orifices
h produce lateral jets and a reaction force for
ing the head. The internal chamber is of sub-
ially larger cross-sectional area than either the
or all the outlet orifices together, to define a
reservoir in which the velocity of the nozzle jet is substantially reduced and is used to pressurize the liquid before it is issued at a high velocity through the outlet orifices. The shaped inlet orifice includes side walls converging towards each other in the direction of the inlet chamber and terminating in a narrow diameter throat at the mouth of the chamber. (Sinha-OEIS)
W79-04466

DRIP IRRIGATION EMITTER,
R. L. Hendrickson.
U.S. Patent No. 4,121,771, 5 p, 5 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1443, October 24, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation practices, *Irrigation efficiency, Application equipment, Soil-water-plant relationships, Water delivery, Drip irrigation.

A drip irrigation emitter or device comprises a flow restrictor helical thread on the outside of a main body, and a cap member that fits over the thread. Water is supplied to the interior of the main body and must flow through a narrow, annular passageway formed by the cap before the water flows through provided restrictor orifices, so no large particles are carried into the orifices or the helical thread to minimize plugging. The water discharges adjacent to the water tube or hose to minimize root intrusion into the irrigation device, and baffles also are provided to minimize root intrusion. The cap can be loosened or removed to flush the thread if foreign material enters the thread. (Sinha-OEIS)
W79-04467

MEANS AND METHOD OF INSTALLING EMITTERS IN IRRIGATION TUBING,
L. Spencer.
U.S. Patent No. 4,122,590, 6 p, 8 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1718, October 31, 1978.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Tubes, Conduits, Drip irrigation, Emitters, Manufacturing.

In the development of drip irrigation, it has become feasible to utilize a thinwall irrigation tube capable of being flattened and compactly rolled to minimize storage and shipping space. This invention describes means and a method of installing emitters in irrigation tubing, wherein a core assembly dimensioned for ready insertion in a thinwall irrigation tube is provided with internal rollers which are confronted by fixed external rollers positioned to function through the walls of the tubing so as to retain the core assembly in a fixed position as the tubing is moved between the internal and external rollers. The core assembly includes an anvil periodically engaged by an external radially moving cutting tool to form in the tubing a series of emitter receiving perforations. The core assembly also includes a fork member for spacing the perforated wall of the tubing from the opposite wall to facilitate reception of emitters forced by an external mandrel. The anvil and fork and their respective cutting tool and mandrel are adapted to be spaced at preselected distances depending on the required emitter spacing. (Sinha-OEIS)
W79-04475

IRRIGATION WATER MOVEMENT BELOW THE CORN ROOT ZONE IN CRETE SILT LOAM,
Kansas State Univ., Manhatten. Evapotranspiration Lab.
For primary bibliographic entry see Field 2G.
W79-04483

RESPONSES OF SEVERAL FORAGE AND FIELD CROPS TO SUBSURFACE SOIL WARMING AND SEWAGE EFFLUENT SPRAY IRRIGATION,
The Pennsylvania State Univ., University Park. Dept. of Agronomy.
G. A. Mellish.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 343, Price codes: A08 in paper copy, A01 in microfiche. Master of Science thesis, 166 p, 21 fig, 29 tab, 58 ref. August 1978. OWRT C-6249(No 5222)(3), 14-34-0001-5222.

Descriptors: *Sewage effluents, *Soil temperature, Cold resistance, Pest control, Soil moisture, Sudangrass, Orchardgrass, Switch grass, Alfalfa, Winterkilling, Mature growth stage, Forage grasses, Field crops, *Irrigation effects, Soil warming.

The influence of soil warming and sewage waste water irrigation on winter survival, maturation, yield, quality, and pest relationships of various crops was evaluated. An electric power plant-soil warming system was simulated by circulating hot water from an oil-fired boiler through a pipe network buried at a 30-cm depth and 60-cm spacing. Treatments consisted of soil temperature regimes which were approximately 13 and 9C above average annual ambient soil temperatures at the 15-cm depth and an ambient soil control. Treatment areas were spray-irrigated with treated sewage waste water twice weekly. Four cropping systems were used. Soil warming delayed the development of autumn cold tolerance in alfalfa, winter wheat, and winter barley and reduced cold tolerance attained by the winter cereal crops. Soil warming stimulated early spring growth and increased the rate of maturation of most crops. Yield responses to soil warming varied with type of crop. Forage quality differences between crops grown on heated and ambient temperature soils were primarily associated with chronological tissue age at harvest. Certain insect species appeared earlier on heated than on ambient plots. Annual and perennial crops could be grown on heated and waste water irrigated soil in the Northeast and double cropping would be more feasible than with a conventional agricultural system. (Sink-Penn State)
W79-04489

THE EFFECT OF COMBINED SOIL WARMING AND IRRIGATION ON THE SOIL SURFACE ENERGY BUDGET,
The Pennsylvania State Univ., University Park. Dept. of Meteorology.
For primary bibliographic entry see Field 2G.
W79-04490

ECONOMICALLY OPTIMUM IRRIGATION PATTERNS FOR GRAIN SORGHUM PRODUCTION: TEXAS HIGH PLAINS,
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
L. R. Zavaleta, R. D. Lacewell, and C. R. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 344, Price codes: A06 in paper copy, A01 in microfiche. Texas Water Resources Institute, Texas A and M University Project Report TR 100, 103, 2 fig, 14 tab, 66 ref, append, January 1979. OWRT A-037-TEX(4), 14-34-0001-7091, 7092 and 8046.

Descriptors: *Irrigation practices, *Sorghum, *Model studies, Irrigation efficiency.

Agricultural production and associated economic effects of irrigation on the Texas High Plains are seriously threatened by a rapidly declining groundwater supply and a swift upward trend in energy costs. To optimize the amount of irrigation water to be applied during specified periods of the production process, a stochastic openloop feedback control policy was built into a grain sorghum growth simulation model. Model application indicates that to maximize net returns, producers will follow a policy of frequent irrigations with smaller applications than currently practiced. The results provide implications for improved water management by the producer and opportunities for irrigation research. Fuel curtailment analysis suggested both the length of curtailment and timing significantly affected expected yield and net returns.
W79-04495

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

GREEN RIVER BASIN SYSTEMS MODELS - DEVELOPMENT OF SIX-HOUR FLOW RECORDS,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
M. S. Jennings, G. H. Toebes, G. E. Staab, and A. R. Rao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 847, Price codes: A05 in paper copy, A01 in microfiche. Report CE-HSE-78-1, October 1978. 92 p. OWRT B-094-IND(2).

Descriptors: *River flow, *Gaging stations, *Data collection, *Flow rates, Streamflow, Water levels, Gradients, Basic data collection, Model studies, Systems operation, Algorithms, *Kentucky, *River stages, *Strip charts, Stope stations, *Green River Basin(KY), Data base, Adjustment algorithms.

Strip chart recordings of river stages in the Green River Basin, KY., were digitized. The purpose was to obtain average flows over 6-hour periods, a time-step desired for the system operation of four Corps of Engineers reservoirs in the basin. It proved necessary to prepare and use a program called STGFLW to (1) convert gage-heights into mean discharges, (2) to format, store and plot data, (3) to obtain sufficient accuracy, (4) to guard against errors, and (5) to make needed checks and adjustments. A program listing, User's Manual as well as a Programmer's Manual are included.
W79-04008

GREEN RIVER DATA BASE SYSTEM,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
S. Stevens, A. R. Rao, G. H. Toebes, and A. Chossiakos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 845, Price codes: A08 in paper copy, A01 in microfiche. Report CE-HSE-78-2, October 1978. 159 p. OWRT B-094-IND (3).

Descriptors: Reservoir operation, *Reservoir management, *Data storage and retrieval, Reservoir releases model studies, *Kentucky, *Reservoir operation data, Data base specifications, Real-time reservoir systems operation, *Green River(KY).

A formal data base management system was developed for use in reservoir operations model development. Time series of reservoir elevations and discharges, of temperature and precipitation, and of stream stages and discharges for the Green River Basin, KY. were collected and stored. Efficient programs for data addition, data editing, data retrieval, and data base commenting were developed. A User's Manual and Programmer's Manual are included. In addition to its utility in model construction, the data base may be useful when satellite and/or radar data increase the input data management problem in real-time reservoir system operation using a comprehensive simulation model.
W79-04009

RESERVOIR SEDIMENTATION AS A FUNCTION OF PRECIPITATION VARIABILITY,
Maryland Univ., Baltimore. Dept. of Geography.
For primary bibliographic entry see Field 4D.
W79-04061

URBAN FLOOD MANAGEMENT: PROBLEMS AND RESEARCH NEEDS,
North Carolina State Univ. at Raleigh.
D. H. Howells.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. WR2, p 193-212, November 1977. OWRT B-062-NJ(14), 14-31-0001-5134.

Descriptors: *Flood control, Flood damage, Flood plain insurance, Flood plain zoning, Research priorities.

Discussion and conclusions are presented of a 1975 panel on urban flood management at the Quail Roost Workshop on Reorientation of Urban Water Resources Research. Topics covered include the need for a restatement of national goals and objectives in terms relevant to state and local interests; standards of performance; Federal, state, and local interactions as they affect the capacity of local government to carry out floodplain management; more exact and reliable techniques for floodplain delineation for land use regulation and flood insurance rates; and social and economic consequences of floodway fringe development under present national policy. Forty-two problem areas are listed for further identification and research.
W79-04089

DEVELOPMENT OF A DRAINAGE AND FLOOD CONTROL MANAGEMENT PROGRAM FOR URBANIZING COMMUNITIES--PART I,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
E. J. Riordan, N. S. Grigg, and R. L. Hiller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 997, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No 85, September 1978. 64 p, 4 fig, 110 ref, 1 append. OWRT B-161-COLO(5). 14-34-0001-7112.

Descriptors: *Drainage programs, *Urban drainage, *Community development, Urbanization, Hydrology, Drainage patterns, Mathematical studies, Cost analysis, Cost allocation, Legal aspects, Project planning, Drainage basins, Drainage systems, Flood control.

An inexpensive, quick drainage management procedure for mitigating community development-induced drainage impacts is presented. The three major elements of a drainage management program are discussed: (1) the technical element establishes the method of flood hydrology calculation; (2) the financial element establishes methods for drainage and flood control cost calculation and cost allocation; and (3) the regulatory element establishes the enforcement mechanism of the drainage management program. The abbreviated planning methodology for calculating project costs, upon which this program is based, can reduce the front-end drainage planning costs by 75 to 80%. The program's cost apportionment method aids the community's financial situation regarding drainage management. It is thought that the total drainage management should be incorporated with effective legislation at the state level and within local subdivision regulations. (See also W79-04110) (Davison-IPA)
W79-04109

DEVELOPMENT OF A DRAINAGE AND FLOOD CONTROL MANAGEMENT PROGRAM FOR URBANIZING COMMUNITIES--PART II,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
E. J. Riordan, N. S. Grigg, and R. L. Hiller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 998, Price codes: A11 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No. 86, September 1978. 226 p, 22 fig, 16 tab, 110 ref, 3 append. OWRT B-161-COLO(5) Pt II, 14-34-0001-7112.

Descriptors: *Drainage programs, *Urban drainage, *Community development, Urbanization, Drainage patterns, Mathematical studies, Cost analysis, Cost allocation, Legal aspects, Project planning, Drainage basins, Flood control, Hydrology.

The three major elements of a drainage control program directed towards mitigating community-development generated induced drainage impacts of a recommended drainage management program are discussed in detail. Various hydrologic predictions used to evaluate development-induced drainage impacts are examined. The predictive capability of some rainfall-runoff models is compared through a statistical analysis of published results from those models, and the sensitivity of project analysis to poor runoff prediction is evaluated. The financial aspect of a drainage management system is developed through a review of the legal issues concerning municipal and developer liability, cost calculation, and cost apportionment. Existing cost calculation and cost apportionment methods are examined, and an engineering approach for apportioning drainage and flood control facility costs between developers and the municipal government was developed. Pertinent legal issues and existing U.S. Drainage Ordinances are discussed regarding the necessary changes that must occur in order to enforce the proposed drainage management system. (See also W79-04109) (Davison-IPA)
W79-04110

ESTIMATING PEAK DISCHARGES IN SMALL URBAN HAWAIIAN WATERSHEDS FOR SELECTED RAINFALL FREQUENCIES, KANE'OHE WATERSHED, O'AHU, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 2B.
W79-04126

HYDROLOGIC AND WATER QUALITY MODELING OF SURFACE WATER DISCHARGE FROM MINING OPERATIONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W79-04134

INTERIM REPORT, SOUTH UMPQUA RIVER VOLUME I: MAIN REPORT.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 4
W79-04139

INTERIM REPORT, SOUTH UMPQUA RIVER VOLUME IV, APPENDICES E THROUGH REPORTS OF COORDINATING AGENCIES.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6
W79-04141

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, SUMMARY REPORT.
Big Muddy River Basin Coordinating Committee, IL.
For primary bibliographic entry see Field 6
W79-04143

COMPREHENSIVE BASIN STUDY: WHITE RIVER BASIN - ARKANSAS AND MISSOURI VOL. 1, MAIN REPORT.
White River Basin Coordinating Committee.
For primary bibliographic entry see Field 6
W79-04146

COMPREHENSIVE BASIN STUDY: WHITE RIVER BASIN - ARKANSAS AND MISSOURI VOL. VI: APPENDIX P - PLAN FORMULATION.
White River Basin Coordinating Committee.
For primary bibliographic entry see Field
W79-04147

OOD PLAIN INFORMATION: BUXTON REEK AND TRIBUTARIES, DEQUINCY, OUISIANA.
my Engineer District, New Orleans, LA.
r primary bibliographic entry see Field 2E.
79-04150

OOD PLAIN INFORMATION: SIXMILE REEK--VICINITY OF PUEBLO, COLORADO.
my Engineer District, Albuquerque, NM.
r primary bibliographic entry see Field 2E.
79-04151

CORD FLOODS IN SOUTHWEST VIRGIN-, APRIL 1977.
rginia State Water Control Board, Richmond; d Virginia Office of Emergency Services, Rich-nd.
r primary bibliographic entry see Field 2E.
79-04153

ILORING A PUMP FOR FARM USE,
Sass Metto.
ri-book Magazine, Vol 5, No 1, p 24-25, 1979. 4

scriptors: *Drainage engineering, *Pumps, arm management, Farm equipment, Tile drain-e, Drainage systems, Land use.

here gravity drainage is impossible or uneconomical, drainage pumps are the only alternative. An xpensive drainage pump system is described. It sists of a prefabricated sump and storage tank de of corrugated steel culvert pipe and can be talled in a day or less. The area to be drained ermines the size of the pump to be selected. If land is diked the resulting ditches provide extra rage and a larger area can be handled by a given e pump. Electricity is the best source of power d the pump should be located at the lowest part the watershed. High land should be drained by vity and separated from the low land to reduce size and cost of the pumping system and nove the hazard of flooding the low land. The m drainage pump will become increasingly im-rtant. As land costs go up, maximum efficiency l be demanded and land that has been pastured followed will be required to produce crops. Tile ins on much of this marginal land will require nping. (Purdin-NWWA)
79-04245

IALL MAMMAL HABITAT IN DIFFERENT-ED CHAMISE-WEDGELEAF CEANOTHUS IAPARRAL,
lifornia Univ., Berkeley. Dept. of Forestry and sources Management.
. Cavallaro.
ailable from the National Technical Information rvice, Springfield, VA 22161 as PB-292 148, ce codes: A06 in paper copy, A01 in microfiche. S. Thesis, October 1978. 112 p, 13 fig, 13 tab, 2 pend. 46 ref. (California Water Resources Center oject UCAL-WRC-W-490).

scriptors: *Watershed management, *Habitats, ammals, *Chaparral, *Forest fires, Brushlands, rning, Wildlife, Wildlife habitats.

ts in chamise-wedgeleaf ceanothus chaparral ich burned eight, fourteen, and twenty-five rs ago were used to examine the vegetational small mammal changes which occur in this getation type as time passes after a fire. Vegeta-n height and litter cover continually increased ong the plots as the length of time increased ce the last fire. Total shrub cover and vertical opy density, however, only increased between eight and fourteen year old plots. Between se two plots, the density of chamise stems and amineae litter cover decreased. Between the rteen and twenty-five year old plots, the density yerba santa and the relative cover of chamise creased whereas the relative cover of wedgeleaf nothus and the ratio of live to dead leaf cover wedgeleaf ceanothus increased. Kangaroo rats d deer mice prefer younger chamise-wedgeleaf ceanothus chaparral which has relatively little shrub cover. Kangaroo rats, in fact, occur only in habitats with less than about 50 percent shrub cover while deer mice also utilize habitats with greater shrub cover. When the shrub cover increases to about 75 percent as time passes after a fire, pinon mice and woodrats begin utilizing chamise-wedgeleaf ceanothus chaparral. Woodrat utilization of this vegetation type is further affected, however, by the presence of other shrub species. Woodrats preferred chamise-wedgeleaf ceanothus chaparral with greater cover of species such as scrub oak, deerbrush, poison oak and toyon. (Snyder-Calif Davis)
W79-04259

GROWTH AND YIELD OF JOJOBA PLANTS IN NATIVE STANDS USING RUNOFF-COLLECTING MICROCATCHMENTS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 3F.
W79-04288

BIOLOGICAL CONTROL OF WATER WEEDS WITH PLANT PATHOGENS,
Florida Univ., Gainesville. Dept. of Plant Pathology.
T. E. Freeman, R. Charudattan, and K. E. Conway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 308, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Florida, Publication No. 45, 1978. 70 p, 3 fig, 5 tab, 57 ref. OWRT A-033-FLA(6), 14-34-0001-8010.

Descriptors: *Biocontrol, Water weeds, Plant pathogens, *Aquatic weed control, Fungi, Waterhyacinth.

Plant pathogens have many characteristics that make them ideal candidates as biocontrols for aquatic weeds. They are: (1) numerous and diverse; (2) frequently host specific; (3) easily disseminated and self-perpetuating; (4) will not completely eliminate a host species; and (5) do not normally affect man or other animals. With these points in mind, a modest program was begun in 1970, with the object of the evaluation and subsequent use of plant pathogens as biocontrol agents for aquatic weeds. The program later was expanded. The program progressed rapidly considering the lack of initial background information. A considerable backlog of information about diseases affecting aquatic plants has been developed. The objective of the utilization of plant pathogens in biocontrol programs for at least one noxious aquatic plant is nearing fruition. Large-scale field evaluation of the fungus Cerospora romanii for control of waterhyacinth is warranted. An additional three or four organisms also should soon be evaluated. Also, an attempt was made to find and research diseases with biocontrol potential for other aquatic weeds. (Morgan-Fla)
W79-04311

NATIONAL FORESTS DO NOT HAVE RESERVED WATER RIGHTS FOR RECREATIONAL PURPOSES,
For primary bibliographic entry see Field 6E.
W79-04417

FREELAND V. DICKSON (LOWER LANDOWNER HAS NO RIGHT TO UNIMPEDED FLOW OF SURFACE WATER ONTO HIS LAND),
For primary bibliographic entry see Field 2F.
W79-04434

UNITED STATES V. STATE OF NEW MEXICO (IMPLIED RESERVATION OF WATER DOCTRINE HELD TO COVER ONLY AMOUNT OF WATER NECESSARY FOR THE PURPOSE OF THE RESERVATION).
For primary bibliographic entry see Field 6E.
W79-04453

AQUATIC HERBICIDES,
Nalco Chemical Co., Oak Brook, IL. (Assignee), J. F. Vartiak, and G. E. Wortley, Jr.
U.S. Patent No. 4,123,249, 4 p, 5 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1942, October 31, 1978.

Descriptors: *Patents, *Herbicides, *Aquatic weed control, Application methods, Polymers, Water soluble polymers.

Aquatic herbicides may be improved in their activity by applying aquatic herbicides under water to the vegetation to be controlled in the presence of a minor amount of a water-soluble vinyl addition polymer which has a molecular weight of at least 10,000 and an inorganic salt capable of cross linking the water-soluble polymer. The water-soluble anionic polymers may be employed in conjunction with the aquatic herbicides in a variety of ways. In one of its simplest forms, it would be applied below the surface of the water through injection nozzles. The polymer and crosslinking agent in the form of a concentrated liquid would be metered into the herbicide pump where it is mixed with the herbicide just prior to where the feed line goes into the application nozzles. (Sinha-OEIS)
W79-04476

4B. Groundwater Management

HYDROLOGIC EVALUATION OF PART OF CENTRAL VOLUSIA COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
P. W. Bush.
Geological Survey Water-Resources Investigations 78-89 (open-file report), 1978. 50 p, 17 fig, 1 tab, 9 ref.

Descriptors: *Groundwater resources, *Water supply, *Withdrawal, *Urbanization, *Saline water intrusion, Model studies, Water wells, Aquifer characteristics, Groundwater movement, Groundwater recharge, Leakage, Wetlands, Water utilization, Water demand, Land use, Planning, Evaluation, Florida, *Volusia County, Floridan aquifer, Pinder-Trescott model.

Municipal wells close to the Atlantic Coast cannot be expected to supply the steadily increasing population of Volusia County, Florida, indefinitely without causing saltwater intrusion problems. Therefore, new wells will be drilled away from the coast. The source of water for the planned artesian aquifer well field will be leakage from the water-table aquifer above. A digital model of the leaky aquifer system indicates that long-term yield of about 20 million gallons per day can be expected without the cone of depression dropping low enough to cause saltwater intrusion. Some types of land development could remove potential recharge from the area. Model tests with decreased leakage indicate that a large amount of potential recharge water would have to be removed from the system to effect an appreciable lowering of the cone of depression. Lowering the recharge potential by 20 percent apparently would have little effect on the cone. Lowering the recharge potential by 60 percent would, according to the model, increase the maximum depth of the cone by 27 percent. Land development that would redistribute potential recharge, rather than drain it away from the system, would have little effect on the aquifer beneath the well field. (Woodard-USGS)
W79-04030

CONJUNCTIVE GROUND AND SURFACE WATER ALLOCATIONS: THE ECONOMICS OF A QUASI-MARKET SOLUTION,
Colorado State Univ., Fort Collins. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W79-04078

ARTIFICIAL RECHARGE: PART II,
National Water Well Association, Worthington, OH.

T. E. Gass.
Water Well Journal, Vol. 33, No. 2, p 32-33, February, 1979.

Descriptors: *Artificial recharge, *Water spreading, *Groundwater recharge, Infiltration rates, Recharge ponds, Flooding, Furrow systems, Infilration, Streambeds, Settling basins, Clogging.

Surface spreading, the most common method of artificial recharge, relies on infiltration to be effective. Various factors which influence infiltration rate are listed. The types of surface spreading systems include: basins or ponds, ditch or furrow networks, flooding systems, and streambed modification. Before construction of a surface spreading system, a survey should be conducted to determine the best type of system for the site, potential effects on water quality and the hydrologic budget and possible changes in plant and animal life. Also, a pilot recharge system should be built to finalize design specifications and develop efficient operation and maintenance procedures. General engineering principles for construction of recharge systems are outlined. Recharge problems are caused by poor quality recharge water, changes in soil structure or soil biology, and mechanical clogging. Clogging can be reduced by constructing a settling basin behind the main basin. Both recharge basins and settling basins should be operated intermittently to allow time for drying. Alternative basins should be available to allow other basins to dry out. (Purdin-NWWA)
W79-04239

WATER SYSTEMS COUNCIL: A VARIETY OF SERVICES TO PUMP MANUFACTURERS AND THE WATER WELL INDUSTRY,
D. Jacuzzi.
Ground Water Age, Vol. 13, No. 5, p 20, 22. January, 1979.

Descriptors: *Trade associations, *Water systems, Water wells, Pumps, Water tanks, Pitless adapters, Marketing, Water users, Standards, Legislation, Education.

The structure and purposes of the Water Systems Council (WSC) are presented. The WSC advertising program is directed toward consumers planning or building homes since they are potential private well owners. Through the media of a newsletter and workshop program, WSC informs sanitarians, county agents and other influence groups about water systems. WSC also educates industry personnel with the WSC's 'Water Systems Handbook' which explains water system design, installation, and maintenance. WSC offers guides to market planning for water systems manufacturers through a shipment reporting program. In 1979, the market reseach service will conduct a survey of private wells in each state together with projections about future well drilling. The Technical Committee determines the Testing and Rating Standards which form the basis of the 'Certified Performance' program. The Government Relations Committee monitors and acts on legislation affecting water systems manufacturers issues. The Ground Water Council support in part by WSC, distributes films and literature to the industry and the public on ground water supply, wells and pumps. (Purdin-NWWA)
W79-04240

HEAT PUMP UPDATE.
For primary bibliographic entry see Field 6B.
W79-04246

WATER WELLS HELP TEXAS CITY SAVE MONEY.
For primary bibliographic entry see Field 6B.
W79-04247

OPTIMIZATION TECHNIQUES APPLIED TO GROUND-WATER DEVELOPMENT,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04406

CARBONATE HYDROGEOLOGIC ENVIRONMENTS: THEIR RELATIONSHIP TO LAND USE, WATER RESOURCES DEVELOPMENT AND MANAGEMENT,
The Pennsylvania State Univ., University Park. Dept. of Geoscience.
R. R. Parizek.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 337, Price codes: A05 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources Pennsylvania State University Research Project Technical Completion Report, Feb. 1979. 95 p, 3 fig. A-005-PA(8), 14-34-0001-8040.

Descriptors: Carbonate rocks, Dolomite, Limestones, Karst, Groundwater, Surface-groundwater relationships, Water table, Water supply, Droughts, Industrial wastes, Land use, Wells.

The elementary problem of where to locate water wells to obtain consistent and maximum yields with least risk for a variety of carbonate rocks was first solved in 1965 as part of this continuing study. The research was initiated to determine the geologic, topographic and land-use factors which govern the occurrence, movement and recharge of groundwater. The interrelationship between surface water and groundwater was investigated and the chemical quality of groundwater for a terrain underlain by nearly 8,000 feet of folded and faulted carbonate rocks was examined. Further, the influences of drought, urbanization, industrialization and recreation related to the physical environment's response to these stresses were investigated. Solid and liquid waste disposal practices were of special concern and attempts were made to define the waste management site selection criteria required to protect important groundwater supplies from threats of pollution. Also of concern were the aspects of the geologic and hydrologic setting in guiding land-use planning to protect groundwater supplies from pollution. Use of fracture traces to locate highly productive water wells is now in wide use in Pennsylvania and elsewhere in the United States, and it is no longer restricted to carbonate rocks. (Tsong-Penn State)
W79-04494

THE USE OF BOUNDING WELLS TO COUNTERACT THE EFFECTS OF GRAVITY IN DIPPING AQUIFERS,
Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
T. E. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 345, Price codes: A05 in paper copy, A01 in microfiche. M.S. Thesis, May 1978, 85 p, 28 fig, 4 tab, 19 ref, 3 append. OWRT A-044-LA(1).

Descriptors: Underground storage, Groundwater storage, *Groundwater movement, Artificial recharges, Gravitational migration, *Injection wells, Bounding wells, Computer programs, *Aquifers.

Bounding wells can be used in a dipping system to effectively prevent the gravitational migration of an injected fluid whose density differs from that of the original aquifer fluid. A computer program was developed to predict the required bounding well flow rates. Bounding well flow rates can be chosen such that a balance exists between injection and production volumes, so that none of the fluid produced by the bounding wells will reach the biosphere. One of the parameters that affect bounding well flow rates is radius of the injected volume of fluid, hence the required bounding well rates change continuously during injection and production of the stored fluid.
W79-04496

4C. Effects On Water Of Man's Non-Water Activities

A CROSS-SECTIONAL INVESTIGATION OF THE DETERMINANTS OF URBAN RESIDENTIAL WATER DEMAND IN THE UNITED STATES, 1960 AND 1970,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 6D.
W79-04003

DUAL PURPOSE DETENTION BASINS AND SURVEILLANCE PROCEDURES IN URBANIZING WATERSHEDS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., and A. W. McIntosh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 989, Price codes: A03 in paper copy, A01 in microfiche. Final Technical Completion Report, January 1979. 29 p, 6 fig, 40 ref. OWRT A-048-NJ(6), 14-34-0001-9032.

Descriptors: Dams, Flood control, Streams, *Detention reservoirs, Multiple purpose projects, Land use, Environmental damage, *Urban runoff, Urbanization, Channel erosion, Monitoring, *Urbanizing areas.

This report covers two subjects, (1) consideration of the use of detention basins for reducing particulate pollution as well as flood retardation, and (2) a system of surveillance for problem evaluation in small urbanizing streams. Small detention basins, which are being built in large numbers to reduce flooding in rapidly urbanizing areas, may be modified to serve additionally the purpose of reducing runoff pollution, which also accompanies urbanization. Only slight reduction in local flood control effectiveness will be entailed by the modificaton, and the dual purpose basins will be more useful in aid of flood control further downstream than the single purpose locally-oriented sturctures. Runoff pollution from urbanizing areas is important to water quality planning, and occurs largely in particulate form. Tentative criteria for interim use are suggested. Conventional stream monitoring is ineffective for small streams because of their variability; and water quality analysis of storm events is too expensive for general use. A system of surveillance is described which provides for problem evaluation through biological surveys and selective physical data gathering.
W79-04077

TO SOLVE HIGHWAY AND FARM WATER MANAGEMENT PROBLEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
R. L. Smith, and C. J. W. Drablos.
Agricultural Engineering, Vol. 59, No. 2, p. 22-24, February, 1978. 4 fig.

Descriptors: *Highway effects, *Drainage, Drainage water, *Soil erosion, Sedimentation, Legal aspects, Soil conservation.

Wherever agricultural lands are crossed by highways, drainage interrelationships between the highway authorities and the adjoining landowners become complex. Engineering and legal judgment plays an important role in finding the satisfactory solutions to these problems. While it may be permissible to temporarily obstruct local highways with ponded water, eroded material, and debris such conditions should not permanently exist on highways which are subject to heavy, high-speed traffic. And care must be exercised to reduce adverse effects on adjoining lands as a result of the highway facilities--for example, the diversion of water from natural water courses, the interception of subsurface drainage systems, the obstruction of the natural water flow. This paper discusses the various aspects of these problems and suggests how the magnitude of most problems can be re

ced which will cause least disruption. (Skoger-e-Colorado State)
79-04190

ORMWATER-RUNOFF DATA FOR A HIGH-AY AREA, BROWARD COUNTY, FLORIDA,
ological Survey, Tallahassee, FL. Water Re-rces Div.
Hardee, R. A. Miller, and H. C. Mattraw, Jr.
ological Survey open-file report 78-612, June 78. 166 p, 2 fig, 4 tab, 6 ref.

scriptors: *Rainfall, *Rain gages, *Storm runoff, rban hydrology, *Water quality, Land use, ter pollution, Basic data collections, Water ld, Water analysis, Chemical analysis, Water lity control, Florida, *Pompano Beach area, oward County, Bulk precipitation.

nfall, stormwater runoff, and water-quality data summarized for a highway area near Pompano ch, Florida. Loads for 21 water-quality con-uents were computed for the runoff from 45 rm events between April 1975 and July 1977. e size of the basin is 58.3 acres and 36 percent ervious. Stormwater runoff from urban water-ds represent an unqualified but possibly major rce of contaminants to the numerous canals in th Florida. The quantification of the contami-e load from different land-use areas will assist vernmental agencies involved with pollution trol in evaluating alternative drainage system igns. (Woodard-USGS)
9-04407

TA NEEDS IN URBAN HYDROLOGY,
ological Survey, Portland, OR. Water Re-rces Div.
primary bibliographic entry see Field 7A.
9-04409

IO OWNS OUR BEACHES,
primary bibliographic entry see Field 6E.
9-04418

AWING THE LINE AT THE OCEANFRONT: E ROLE OF COASTAL CONSTRUCTION TBACK LINES IN REGULATING DEVEL-MENT OF THE COASTAL ZONE,
ssard L. Holland Law Center, Gainesville, FL.
primary bibliographic entry see Field 2J.
9-04432

NPOINT SOURCE POLLUTION,
primary bibliographic entry see Field 5A.
9-04443

ELSMANN V. STATE (RECOVERY DENIED R LOSS OF WELL WATER CAUSED BY HWAY CONSTRUCTION).
primary bibliographic entry see Field 2F.
9-04456

. Watershed Protection

ERVOIR SEDIMENTATION AS A FUNC-N OF PRECIPITATION VARIABILITY,
yland Univ., Baltimore. Dept. of Geography.
. Harlin.
er Resources Bulletin, Vol. 14, No. 6, p 1457-, December 1978. 4 fig, 3 tab, 8 ref.

criptors: *Sedimentation, *Reservoirs, cipitation(Atmospheric), Land use, Precipita-intensity, Reservoir silting, Sediment yield, ar programming, Runoff, Fluvial sediments, cipitation variability, *Reservoir sedimenta-Linear relationships, Coefficient of variation, ual precipitation, Cost-benefit ratio, Step-wise ession, Multicolinearity.

mentation-precipitation variability was exam-as a critical factor in reservoir design. The ficient of variation for annual precipitation, computed for the period relating to sedimentation, was regressed against sediment yields for several reservoirs over a wide range of environmental settings. A significant linear relationship resulted, and when precipitation variability was combined with several additional variables available from reservoir summary sheets, almost 83% of the total variation in sediment yield was accounted for. It was suggested that the coefficient of variation for annual precipitation fulfilled a direct process role when modeling reservoir sedimentation much more effectively than annual precipitation or runoff. (Roberts-ISWS)
W79-04061

A FINITE ELEMENT HYDROLOGIC MODEL TO DETERMINE THE EFFECT OF LAND MANAGEMENT PRACTICES ON EROSION AND SEDIMENTATION IN A WATERSHED,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
B. B. Ross, V. O. Shanholtz, and D. N.
Contractor.
Paper presented at 1978 Water Meeting American Society of Agricultural Engineers, Chicago, Illinois, Dec 18-20, 1978. Paper No. 78-2507, ASAE, St. Joseph, Michigan, 42 p, 11 fig, 7 tab, 41 ref. OWRT A-077-VA(3).

Descriptors: *Finite element model, *Flood flow routing, Land use, Erosion, Sediment transport, Watershed model.

This research proposes the use of a finite element flood routing model for simulating erosion and sediment transport. This computer-based spatially responsive model represents one approach to incorporating spatial heterogeneity and a conceptual framework for tracing non-point sources of pollution. A conceptual framework is provided whereby detailed spatiotemporal variations in such factors as soils, land-use topography, and rainfall can be integrated to predict water quantity and quality. Therefore, the effect of various land-use management practices on erosion and sediment transport can be determined.
W79-04091

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME I: MAIN REPORT.
Army Engineer District, Portland, OR.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 542, Price codes: A10 in paper copy, A01 in microfiche. Review Report on Umpqua River and Tributaries, OR., December 1971, 141 p, 9 tab, 4 plates, 3 exhibits, attachment.

Descriptors: *Planning, *Water resources development, *Watershed management, *River basin development, *Umpqua River(OR), *South Umpqua River(OR), Oregon, Non-structural alternatives, Multiple-purpose projects, Multi-purpose reservoirs, Geology, Topography, Climate, Hydrology, Flooding, Economics, Natural resources, Environmental effects, Irrigation, Power system operation, Water quality, Navigation, Cost-benefit analysis, Fish management, Construction, Water supply, Anadromous fish, Environmental impacts, Structural alternatives.

This is the Main Report of a 4-volume study and summarizes a plan for the solution of water resource problems in the area drained by the South Umpqua River, one of the Umpqua River's two principal tributaries. The South Umpqua River drainage contains the main center of population and economic development in the Umpqua River Basin, for which the study was authorized. The Basin has problems of both flooding and water shortage. A general description of the watershed is given, including geology and topography, natural resources, and environmental factors. Economic development is reviewed through population, industry and transportation, and utilities. Climate and hydrology are studied; flooding is then assayed. Problems and solutions considered are presented for flooding, irrigation, power generation, water supply, fish and wildlife, recreation, water quality and navigation. Plans are considered and formulated and their environmental impacts reviewed. Costs are estimated, compared with benefits, and methods of allocation and repayment are proposed. Finally, local participation and institutional coordination are discussed. Conclusions are that serious flood and water shortage problems exist and that structural measures must be adopted to solve these problems; the anadromous fish runs are national and international resources, and the federal government should take responsibility for the enhancement of these resources; and that most of the costs borne by implementation of the recommendations are reimbursable by potential users. Recommended is the construction of a multiple-purpose storage project for flood control, irrigation, municipal and industrial water supply, fishery enhancement, recreation, and water quality control. (Zayac-NC)
W79-04139

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME IV, APPENDICES E THROUGH J, REPORTS OF COORDINATING AGENCIES.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6G.
W79-04141

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, SUMMARY REPORT.
Big Muddy River Basin Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04143

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, VOL. 7, APPENDIX M AND N.
Big Muddy River Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04144

SMALL MAMMAL HABITAT IN DIFFERENT-AGED CHAMISE-WEDGELEAF CEANOTHUS CHAPARRAL,
California Univ., Berkeley. Dept. of Forestry and Resources Management.
For primary bibliographic entry see Field 4A.
W79-04259

EFFECTIVENESS OF SEDIMENT-CONTROL TECHNIQUES USED DURING HIGHWAY CONSTRUCTION IN CENTRAL PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. A. Reed.
Availability Supt. of Documents, GPO, Washington, DC 20402 Price $2.25. Geological Survey Water-Supply Paper-2054, 1978. 57 p, 36 fig, 11 tab, 10 ref.

Descriptors: *Sediment control, *Watersheds(Basins), *Sediment yield, *Road construction, *Pennsylvania, Ponds, Trap efficiency, Sediment discharge, Sediment transport, Sediment load.

A different method for controlling erosion and sediment transport during highway construction was used in each of three adjacent drainage basins in central Pennsylvania. In one basin three offstream ponds were constructed to intercept runoff from the construction area before it reached the stream. In another a large onstream pond was constructed on the main stream below the construction area. The offstream ponds trapped 60 percent of the sediment that reached there. The onstream pond trapped about 60 percent of the sediment that reached there. The onstream pond trapped about 80 percent of the sediment that reached it; however, it kept the stream turbid for long periods after storms. In the third basin seeding and mulching reduced sediment loads about 20 percent during construction, and small rock dams reduced sediment loads about 5 percent. (Woodard-USGS)

W79-04403

THE LEGAL SIGNIFICANCE OF THE LOCAL GOVERNMENT COMPREHENSIVE PLAN,
For primary bibliographic entry see Field 6E.
W79-04420

EROSION PREDICTION ON CALIFORNIA RANGELAND: RESEARCH DEVELOPMENTS AND NEEDS,
California Univ., Davis. Dept. of Land, Air, and Water Resources.
M. J. Singer, G. L. Huntington, and H. R. Sketchley.
In: Soil Erosion: Prediction and Control, Proceedings of National Conference on Soil Erosion, May 24-26, 1976, Purdue University, West Lafayette, IN. p 143-151. Soil Conservation Society of America, Ankeny, IA. (1976). (California Water Resources Center Project UCAL-WRC-W-502).

Descriptors: *Erosion, *Rangeland, Soil erosion, Erosion rates, Erosion control.

It is imperative that land use planners and land managers know the nature of the soil resource and the effects of changing uses on that resource. Because of the steep rangeland terrain, soil erosion is a potential problem. In fact, two problems exist. First, tolerable soil loss levels are low because of the thin soils and relatively slow rate of soil formation. Second, these soil losses contribute to nonpoint pollution. The universal soil loss equation (USLE) offers an attractive method for predicting the potential erosion losses under known rainfall, soil, topographic, and use conditions. Because of its wide acceptance in agriculture east of the Rocky Mountains and the basic approach taken in developing the factors, it is logical to attempt to use the equation west of the Rocky Mountains for predicting potential erosion losses in California's rangeland. Work has proceeded along three paths: field research using standardized plots, laboratory and field research on mini-plots with a portable rainfall simulator, and computer modeling using field and laboratory data. (Snyder-Calif Davis)
W79-04487

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

VIABILITY MEASUREMENTS ON ACTIVATED SLUDGE,
Alabama Univ. in Birmingham. Dept. of Biology.
For primary bibliographic entry see Field 5D.
W79-04006

EXPERIMENTAL EVALUATION OF CHEMICAL TRANSPORT IN WATER-SATURATED POROUS MEDIA: 2. SORBING MEDIA,
Oregon State Univ., Corvallis. Dept. of Soil Science.
S. K. Saxena, F. T. Lindstrom, and L. Boersma.
Soil Science, Vol 118, No 4, p 238-242, 1974. 1 fig, 1 tab, 6 ref. OWRT B-001-ORE(14) Part 2.

Descriptors: *Path of pollutants, *2,4-D, *Waste water treatment, Pesticides, Leaching, Tracking techniques, Water pollution, Model studies, Equations, Laboratory tests, Evaluation, Porous media, Sorption, Dispersion.

A theoretical dispersion model, previously developed to determine dispersion profiles at different levels of sorption, is evaluated. Dispersion profiles of 2,4-dichlorophenoxyacetic acid in sorbing porous media show the increase in dispersion with increasing pore size. The sorbing characteristics of the porous media produced a distinct tailing along the trailing edge of the moving chemical front. The equation describing the experiments is presented. Experimental results agreed with the theoretical predictions; a set of experiments using glass beads coated with twice as much resin produced similar agreement. (See also W74-12306) (Davison-IPA)
W79-04014

CONTENTS OF SOME HEAVY METALS IN NORWEGIAN RIVERS,
Institutt for Atomenergi, Kjeller (Norway). Isotope Labs.
K. Lenvik, E. Steinnes, and A. C. Pappas.
Nordic Hydrology, Vol. 9, No. 3/4, p 197-206, 1978. 1 fig, 3 tab, 14 ref.

Descriptors: *Heavy metals, *Rivers, *Pollutants, Sampling, Chemical analysis, Water chemistry, Neutron activation analysis, Zinc, Cadmium, Arsenic, Cobalt, Molybdenum, Uranium, Surveys, On-site data collections, Data processing, *Norway, *Norwegian rivers.

Concentration data for the elements arsenic, cadmium, cobalt, molybdenum, zinc, and uranium in 11 Norwegian rivers, determined by neutron activation analysis, were presented. The mean values of the various rivers showed the following range for the elements studied (micrograms/liter): As, less than 0.02-1.05;Cd, less than 0.06-0.43;Co, 0.09-0.46; Mo less than 0.10-1.62;Zn, less than 2-53; U, 0.041-0.58. The weighted mean values in this work were similar to the estimated world averages for rivers in the case of Co and Zn. For As, Mo, and U, the present values were lower than the world averages by a factor of 3 or more. This may be due to lower abundance of sedimentary rocks and deposits in Norway compared with the drainage basins of some of the major rivers in the world. (Sims-ISWS)
W79-04021

AN ASSESSMENT OF WATER QUALITY IN THE SPOON RIVER, PART 2,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions, Illinois State Academy of Science, Vol. 70, No. 3/4, p 272-285, September-December 1977. 14 fig, 3 tab, 9 ref.

Descriptors: *Water quality, *Rivers, *Illinois, *Sampling, Streamflow, Chemicals, Water chemistry, Calcium, Magnesium, Sulfates, Manganese, Iron, Silica, Phosphorus, Phosphates, Pollutants, Water pollution, Data processing, Analytical techniques, *Spoon River(IL).

The spatial and temporal variations of calcium, magnesium, manganese, iron, silica, sulfate, and phosphorus at 5 locations on the Spoon River were reported. Stream gaging data at the sampling sites and synthesized flow data, where flow measurements were lacking, were used to calculate the nutrient loads transported by the river. Results of the 2-year study showed: (1) the spatial distribution of calcium and magnesium differs very little along the river; (2) sulfate concentrations tend to increase in the downstream direction; (3) total iron concentrations exceed the Illinois Pollution Control Board limit of 1 mg/l 90% of the time; (4) concentrations of silica range from 9.36 mg/l at Modena to 7 mg/l at Havana; and (5) phosphorus concentrations exceed the state standards 100% of the time at Modena and about 90% of the time at London Mills, Seville, and Havana. (Sims-ISWS)
W79-04047

AN ASSESSMENT OF WATER QUALITY IN THE SPOON RIVER, PART 1,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions, Illinois State Academy of Science, Vol. 70, No. 3/4, p 253-271, September-December 1977. 20 fig, 3 tab, 8 ref.

Descriptors: *Water quality, *Rivers, *Illinois, *Sampling, Temperature, Water temperature, Dissolved oxygen, Turbidity, Hydrogen ion concentration, Alkalinity, Hardness(Water), Nitrates, Ammonia, Nitrogen, Chemical oxygen demand, Suspended solids, Dissolved solids, Chemicals, Data processing, Analytical techniques, Pollutants, Water pollution, *Spoon River(IL).

The physical and chemical water quality characteristics of the Spoon River, covering a period of 2 years from June 1971 through May 1973, were presented in this report. The river water temperature exhibited distinct annual cyclic fluctuations. The dissolved oxygen concentration showed a remarkable degree of inverse relationship to water temperatures. The nitrate concentrations in the Spoon River were the highest at Modena and decreased progressively downstream. The nitrate-nitrogen concentrations in the Spoon River at Havana and Seville met the Illinois Pollution Control Board standard of 10 mg/l as nitrogen at all times, whereas the limit was exceeded at the other 3 sampling locations about 5% of the time. The nitrate-nitrogen contribution to the river from the watershed ranged from 16.5 lbs/ac/yr at Modena to 10 lbs/ac/yr at Havana. (Sims-ISWS)
W79-04048

PROJECTING URBAN RUNOFF FLOWS AND LOADS,
Basic Technology, Inc., Pittsburgh, PA.
For primary bibliographic entry see Field 5B.
W79-04050

ASSESSING NONPOINT WATER QUALITY FOR SMALL STREAMS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04051

STORMWATER ANALYSIS AND PREDIC TION IN HOUSTON,
Rice Univ., Houston. TX. Dept. of Environmenta Science and Engineering.
For primary bibliographic entry see Field 5B.
W79-04052

JUNE 1976 POLLUTION OF LONG ISLANI OCEAN BEACHES,
State Univ. of New York at Stony Brook.
For primary bibliographic entry see Field 5B.
W79-04053

AMMONIA IN TEXAS STREAMS DURIN(LOW FLOW FROM MUNICIPA WASTEWATER,
Texas Univ. Health Science Center at Houstor School of Public Health.
For primary bibliographic entry see Field 5B.
W79-04063

A MODEL OF THE BEHAVIOR OF PH DI TERMINING PARAMETERS IN IMPOUNI MENTS,
Pennsylvania State Univ., University Park. Dep of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04064

RADIUM-226 IN GROUND WATER OF WES CENTRAL FLORIDA,
Office of Radiation Programs, Las Vegas, N
For primary bibliographic entry see Field 5B.
W79-04065

WELLS AND PONDS: WATER QUALITY AN SUPPLY,
Illinois Univ. at Urbana-Champaign. Dept. of A ricultural Engineering.
For primary bibliographic entry see Field 3C.
W79-04068

HYDROLOGIC PARAMETERS FROM LAN SAT IMAGERY FOR WILLIAMS FORK W TERSHED,
Colorado State Univ., Fort Collins. Civil En

ept.
se Elvecio Pernia.
vailable from the National Technical Information rvice, Springfield, VA 22161 as PB-292 083, ice codes: A07 in paper copy, A01 in microfiche. S Thesis, Spring 1978. 124 p, 16 fig, 15 tab, 46 . OWRT B-160-COLO(1).

escriptors: *LANDSAT, *Watersheds, Snowver, Runoff, *Geomorphology, Satellites, Wilms Fork Watershed(Colo).

e possibility of using LANDSAT satellite data obtain information useful in the hydrologic anals of mountainous watersheds was explored. apping the major cover types of the Williams rk Watershed, extracting physiographic paramrs of the basin, and temporal mapping of snowver were the main objectives. In classifying the jor types, the modified unsupervised (clustering) proach was applied to the LANDSAT MSS gital data. 20 classes representing 17 major inforational cover types present in the Williams Fork atershed were defined. The variable probability mpling method was used in the random selection sample units to check the computer-aided classiation performance. Color infrared aerial photogphy at 1:24,000 and 1:62,000 scales provided the quired ground truth. Average weighted errors nging from 7% to 12.2% were found. A test area approximately 8% of the watershed area was ected to evaluate the computer classification of e tundra cover types. The differences between e results from the computer maps and the interetation of the aerial photography ranged from % to 10.4%. An average weighted root mean uare deviation of 12.1% was found. Visual interetation of LANDSAT MSS transparencies prode approximate information about location and tension of only four broad land cover categories rest, non-forest, tundra, and water). Physiogra ic parameters including watershed area, perimer, basin shape, basin axial length, length of main eam, total stream length, drainage density and ainage pattern were derived from the LANDAT MSS transparencies. Temporal snowcover apping of the Williams Fork Watershed was perrmed for 1975 and 1976, using a Zoom Transfer ope, on the LANDSAT transparencies, for USS nd 5.
79-04073

ICROBIAL GROWTH ON HYDROCARBONS SOME EXPERIMENTAL RESULTS,
node Island Univ., Kingston. Dept. of Chemical ngineering.
K. Velankar, S. M. Barnett, C. W. Houston, and R. Thompson.
otechnology and Bioengineering, Vol. 17, p 241-1, 1975. 6 fig, 13 ref.

escriptors: *Microorganisms, *Pseudomonas aerginosa, *Growth rates, Laboratory tests, Model udies, Microbiology, Surface tension, Analytical chniques, Biochemistry, Carbon.

xperimental results supporting a proposed model r the transport of hydrocarbon in a fermentation stem are reported. This model considers that the esence of micelles of surface active agents are sential to the growth of microbial cells on hydrbon substrates. Pseudomonas aeruginosa was own on a heptane substrate in a shake flask. rowth was monitored by optical density; microopic examination determined that optical density easurements were reproducible. The work of her researchers is interpreted using this model. rther research is recommended. (Davison-IPA)
79-04101

EVELOPMENT AND ASSESSMENT OF CUTE BIOASSAY TECHNIQUES FOR THE ITTORAL ROTIFER, PHILODINA ACUTIORNIS,
irginia Polytechnic Inst. and State Univ., Blacksrg. Dept. of Biology.
. L. Buikema, Jr., J. Cairns, Jr., and G. W. llivan.
vailable from the National Technical Information ervice, Springfield, VA. 22161 as PB-290 937, Price codes: A03 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University. Completion Report (1973), 35 p, 18 fig, 3 tab. OWRT-A-047-VA(1).

Descriptors: *Bioassay, *Rotifers, Heavy metals, Cadmium, Copper, Cobalt, Mercury, Lead, Nickel, Chromium, Silver, Zinc, Ammonium, Salt, Phenols, Toxicity, Philodina acuticornis.

Techniques were examined for using Philodina as a bioassay organism. The toxicity of 12 heavy metals, ammonium chloride and phenol to Philodina were studied. In soft water the order of toxicity (most to least) was: cadmium, mercury and copper, zinc, silver, nickel (chloride), chromium, nickel (sulfate), lead, cobalt, ammonium chloride and phenol. In hard water the order was cadmium, mercury, zinc, copper, chromium and lead. The chloride salts of cadmium and zinc were less toxic than sulfate salts. Nickelous sulfate was less toxic than the chloride salt. The toxicity of zinc decreases as water hardness and alkalinity increases. Calcium is the principal zinc antagonist at hardnesses less than 90 ppm, magnesium is at hardnesses greater than 90 ppm. Toxicity of zinc is less at 10 C but there were no differences between 20 and 30 C. Rotifer eggs are resistant to zinc concentrations that cause 100% mortality of adults. Young are more sensitive than adults. There was no apparent effect of population size on toxicity. The probit analysis, commonly used in bioassay research, may not be a satisfactory statistical analysis when studying populations of organisms of various age or size structure.
W79-04120

LET'S UPGRADE THE BOD TEST,
Arthur Bros. Co., Inc., Fond du Lac, WI.
R. M. Arthur.
Water and Sewage Works, Vol. 121, No. 6, p 100-102, June, 1974. 2 fig, 11 ref.

Descriptors: *Biochemical oxygen demand, *Analytical techniques, Laboratory equipment, Standards, Instrumentation, Water pollution, Biochemistry, Water analysis, *Manometric method of BOD.

The manometric method of performing the BOD test as contrasted to the dilution method is discussed. A new method of determining BOD using modern instrumentation is recommended and explained. The new method has the following advantages: it is a biochemical test; the simplest of manipulative skills are required; it requires a low capital investment for equipment and less daily labor costs; it is similar to the dilution techniques and can be accepted as a Standard test; and large undiluted samples are used. In addition, it simultaneously measures rate as well as total oxygen demand: shorter time is needed to provide information about the strength of a waste; and the results are more accurate than the dilution method. (Orr-FIRL)
W79-04277

TOXICITY OF CUPRIC ION TO EGGS OF THE SPOT LEIOSTOMUS XANTHURUS AND THE ATLANTIC SILVERSIDE MENIDIA MENIDIA,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
For primary bibliographic entry see Field 5C.
W79-04314

THE EFFECT OF PETROCHEMICAL STRUCTURE ON METHANE FERMENTATION TOXICITY,
Drexel Univ., PA. Environmental Studies Inst.
W. L. Chou, R. E. Speece, R. H. Siddiqi, and K. McKeon.
Progress in Water Technology, Vol. 10, No. 5-6, p 545-558, 1978. 21 fig, 4 tab, 17 ref.

Descriptors: *Waste water treatment, *Chemical wastes, *Microbial degradation, *Fermentation, *Methane bacteria, Chemical reactions, Chemical analysis, Toxicity, Bacteria, Heavy metals, Anaerobic bacteria, Chemical properties, Organic compounds, Methane, Alcohols, Acids, *Petrochemicals.

Wastewaters from petrochemical plants are commonly treated by energy intensive aerobic processes. Anaerobic digestion of such wastes would not only result in saving energy, but would also produce methane gas which could be utilized as fuel. Further, the process requires a lower input of inorganic nutrients as compared to aerobic treatment and can be used with wastes containing toxic heavy metals. It also produces a lower quantity of excess sludge. This study was designed to evaluate the effect of molecular structure on toxicity to methane fermentation. Fifty-two petrochemicals were assayed. Toxicity to unacclimated methane cultures developed on acetate substrate was assayed. The results showed definite correlations of molecular structure and toxicity. Chloro substitution, aldehydes, double bonds and benzene rings exhibited toxicity to unacclimated cultures. The addition of hydroxyl groups and increased carbon chain length decreased the above toxicities. Acclimation to a toxic compound substantially reduced its toxicity in the case of aldehydes, double bonds and benzene rings. (Deal-EIS)
W79-04315

ACUTE TOXICITY OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL TO THE MANILA CLAM,
California Univ., Bodega Bay. Bodega Marine Lab.
For primary bibliographic entry see Field 5C.
W79-04323

THE PETROLEUM-INDUCIBLE MIXED-FUNCTION OXIDASE OF CUNNER (TAUTOGOLABRUS ADSPERSUS WALBAUM 1792): SOME CHARACTERISTICS RELEVANT TO HYDROCARBON MONITORING,
Memorial Univ. of Newfoundland, St. John's. Dept. of Biology.
D. G. Walton, W. R. Penrose, and J. M. Green.
Journal of the Fisheries Research Board of Canada, Vol. 35, p 1547-1552, 1978. 3 fig, 54 tab, 22 ref.

Descriptors: *Enzymes, *Oil pollution, *Fish physiology, Oil, Animal metabolism, Organic compounds, Biochemistry, Proteins, Oil spills, Mussels, Fish reproduction, Spawning, Chemical reactions, *Cunner, *Tautogolabrus, *Crude oil.

The hepatic aryl hydrocarbon hydroxylase of the cunner is a sensitive indicator of petroleum contamination. This fish is a particularly favorable species because of its limited home range and ease of capture. Oil concentrations of 1-2 mg/L in water caused two-to sixfold induction of the enzyme above uninduced levels; induction decayed in <7 d after exposure ceased. Feeding of crude oil or mussel tissue contaminated with oil at a concentration of 500 mg/kg caused up to fivefold induction. Males maintained a constant specific activity of aryl hydroxylase through the season, but females had a decreased activity before spawning. Starvation may also have reduced AHH activity. Correlations with liver and body weight were not observed. 2,5-Diphenyloxazole was found to be a safe substitute for benzo(a)pyrene in the assay. (Deal-EIS)
W79-04324

SWIMMING SPEEDS OF OYSTER LARVAE CRASSOSTREA VIRGINICA IN DIFFERENT SALINITIES AND TEMPERATURES,
New Jersey Oyster Research Lab., New Brunswick.
H. Hidu, and H. H. Haskin.
Estuaries, Vol. 1, No. 4, p 252-255, 1978. 3 fig, 12 ref.

Descriptors: *Oysters, *Salinity, *Water temperature, *Animal behavior, Larval growth stage, Growth stages, Toxicity, Animal physiology, Swimming, Water Chemistry, Estuaries, Tidal effects, *Formalin, *Geotaxis, *Phototaxis.

Swimming speeds of oyster larvae were determined in constant and increasing salinities to learn more about the oyster larval 'salinity response.' 'Normal' non-directed swimming speeds ranged from less than 1 cm/min for early veligers to 5 cu/min for 'eyed' veligers with temperature an important variable. When subjected to hourly salinity increases of 0.5%, most larvae swam upward or downward at approximately 3 times the above speeds. Larvae with valves closed in response to traces of formalin sank at speeds of 5 to 50 cm/min depending on larval stage. The results may explain the differential vertical position of larval stages in estuaries and suggest the presence of a taxic component to the salinity response. (Deal-EIS)
W79-04325

SPECTROPHOTOMETRICALY ASSAYED INHIBITORY EFFECTS OF MERCURIC COMPOUNDS ON ANABAENA FLOS-AQUAE AND ANACYSTIS NIDULANS (CYANOPHYCEAE),
New Orleans Univ., LA. Dept. of Biological Sciences.
D. J. Thomas, and J. G. Montes.
Journal of Phycology, Vol. 14, p 494-499. 1978. 1 tab, 23 ref.

Descriptors: Metals, *Mercury, Water pollution effects, *Algae, Mercuric chloride, Methylmercuric chloride, Phenylmercuric acetate, Bioassay, Laboratory tests, Phytoplankton, *Blue green algae, *Inhibition, Spectrophotometry, Inhibitory effects, Growth rates, Anabaena, Anacystis.

The growth-related inhibitory effects of mercuric chloride (MC), methylmercuric chloride (MMC) and phenylmercuric acetate (PMA) (each at 1, 10, 10 to the 2nd power, 10 to the 3rd power ppb) were measured in Anabaena and Anacystis. Optical density changes of control cultures compared against those of experimental cultures showed than MC was the least inhibitory of the compounds. MMC was the most inhibitory, producing statistically significant inhibition at a concentration as low as 1 ppb in Anabaena. PMA was more inhibitory than MC but less than MMC. Effects caused by the mercury compounds included bleaching of individual cells, cell size changes and destruction of whole cells; the degree and extent of these effects depended on the compound and its concentration in the nutrient medium. The high sensitivities of the algae tested suggested the possibility of using them as test organisms in bioassays for mercury. (Katz-EIS)
W79-04327

FURTHER STUDIES ON BIFIDOBACTERIA AS INDICATORS OF FAECAL POLLUTION IN WATER,
Newcastle-upon-Tyne Univ. (Great Britain). Dept. of Civil Engineering.
L. M. Evison, and S. Morgan.
Progress in Water Technology, Vol. 10, No. 5-6, p 341-350, 1978. 3 fig, 4 tab, 10 ref.

Descriptors: *Pathogenic bacteria, *E. coli, *Enteric bacteria, Cytological studies, Epidemiology, Coliforms, Sewage bacteria, *Bioindicators, Chemical analysis, Biochemistry, Cultures, Farm wastes, Domestic wastes, *Bifidobacteria.

Additional data on the distribution, identification and growth reactions of the bifidobacterium group of bacteria support preliminary reports that the organisms are more numerous than E. coli, and are widely distributed in all human faecal specimens. Growth responses of typed cultures of bifidobacteria indicate that the organisms are very unlikely to regrow in the extra-enteral environment. It seems that further research into the use of this group of organisms as an indicator of faecal pollution of water is justified. (Deal-EIS)
W79-04328

RELATIONSHIP BETWEEN INDICATOR ORGANISMS AND SELECTED PATHOGENIC BACTERIA IN URBAN WATERWAYS,
Johns Hopkins Univ., Baltimore, MD Environmental Health.
V. P. Olivieri, K. Kawata, and C. W. Kruse.
Progress in Water Technology, Vol. 10, No. 5-6, p 361-379, 1978. 5 fig, 5 tab, 6 ref.

Descriptors: *Pathogenic bacteria, *Bioindicators, *Urban runoff, Pseudomonas, Salmonella, Water quality, Coliforms, Bacteria, Storm runoff, Streams, Sewage bacteria, Sewage, Urban drainage, Storm water, *Staphylococcus.

Samples were collected from sewage, urban streams, and stormwater runoff over a thirteen month period and assayed for the levels of total coliform, fecal coliform, fecal streptococci, Salmonella sp., Pseudomonas aeruginosa and Staphylococcus courses. P. aeruginosa was the most numerous, S. aureus was found at low levels, and Salmonella required concentration for enumeration. Positive correlations between the levels of indicator and pathogenic bacteria were observed when all the samples and the routine examined background samples from sewage, urban streams, and raw water reservoir were considered. (Katz-EIS)
W79-04330

IN VIVO EFFECT OF ENDRIN ON THREE PHOSPHATASES IN KIDNEY AND LIVER OF THE FISH OPHIOCEPHALUS PUNCTATUS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-04333

LEVELS OF BLOOD GLUCOSE AND TISSUE GLYCOGEN IN TWO LIVE FISH EXPOSED TO INDUSTRIAL EFFLUENT,
Centra Fisheries Extension Training Center, Hyderbad (India).
A. D. Diwan, H. G. Hingorani, and N. C. Naidu.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 269-272, 1979. 2 tab, 12 ref.

Descriptors: *Chemical wastes, *Toxicity, *Fish physiology, Industrial wastes, Sewage effluents, Chemical properties, Chemical analysis, Animal metabolism, Mortality, Proteins, Carbohydrates, *Tissue analysis, *Heteropneustes, *Clarias, Blood glucose levels.

Fish were exposed to complex chemical wastes from an industrial area near Hyderbad, India. First, LC50 values were determined for both species of fish tested (Heteropneustes fossilis and Clarias batrachus). Next, 6 fish of each species were exposed to 50% of the LC50 for 15 days. The fish were then sacrificed and tissue glycogen and blood glucose levels determined. There was 92.2% and 95.3% increase in blood glucose level of H. fossilis and C. batrachus, respectively, after exposure to effluents. In C. batrachus a significant decrease in glycogen level was found in liver, muscles and gills, whereas in heart and kidney there was a slight increase. A significant decrease in glycogen level in H. fossilis was observed only in liver and gills. In muscles of H. fossilis there was a 13.2% decrease in glycogen level which is not significant. (Deal-EIS)
W79-04338

ARSENIC ACCUMULATION, TISSUE DISTRIBUTION AND CYTO-TOXICITY IN TELEOSTS FOLLOWING INDIRECT AQUEOUS EXPOSURES,
Texas Univ. at Austin. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-04344

ALTERATION IN THE ACTIVITIES OF THREE PEPTIDASES AND LIPASE IN THE DIGESTIVE SYSTEM OF THE FISH CHANNA PUNCTATUS EXPOSED TO LEAD NITRATE,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-04345

RAPID METHOD FOR DETERMINING NUMBERS OF SEWAGE POLLUTION BACTERIA (E.G., COLIFORMS) IN WATER,
Vanderbilt Univ., Nashville, TN. School of Engineering.
G. W. Malaney, and R. D. Tanner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 244, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center, University of Tennessee, Knoxville, Research Report No. 66, December 1978. OWRT A-050-TENN(1), 14-34-0001-8045.

Descriptors: *Sewage bacteria, *Coliforms, Culture media, Impedance method.

A 6-8 hour method for estimating the density of total coliform bacteria in water based on change in impedance in diagnostic culture media was developed. The change is brought about by the growth and/or biochemical activity of the coliforms. The diagnostic culture media combination was m-Endo Broth as enrichment, followed by BGLB Broth. The estimation technique was based on the cut-off time method of Hardy, Kraeger, Dufour and Cady (Appl. Environ. Microbiol., 34, 14. 1977). Cut-off time was defined as the incubation time required to produce a change of + or - 0.010 in impedence ratio. Cut-off time was correlated with coliform density by running a total coliform count on the same water sample by Standard Methods Membrane Filter Method.
W79-04389

WYOMING'S SPECKLED DACE,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. J. Engelke, Jr.
Wyoming Wildlife, Vol. XLIII, No. 1, p 24, January 1979.

Descriptors: *Water quality, *Fish, *Wyoming, *Perennial streams, *Intermittent streams, Lakes, Ponds, Springs, Forage fish, Aquatic habitats, *Speckled dace, *Water quality indicator, Green River basin, Southwestern Wyoming.

The speckled dace, a nongame fish species, is a resident in intermittent and perennial streams in the prairies of southwestern Wyoming where energy resources may be developed. The speckled dace is the only species in many waters in southwestern Wyoming and may be an important indicator of adverse impacts in these waters. An unrecorded spawning method of the speckled dace has been observed and is described. (Woodard-USGS)
W79-04408

MARINE RECEIVING WATER MONITORING PROGRAM FOR PULP MILL EFFLUENT (OF CANADIAN CELLULOSE CO. LTD.) AT PRINCE RUPERT,
Canadian Cellulose Co. Ltd., Prince Rupert (British Columbia).
D. S. N. Ho.
In: Canadian Pulp and Paper Association Technical Section, Spring Conference, May 17-21, 1978, Jaspar, Alberta, Preprinted Proceedings, p 92-97. 10 fig, 10 ref, 2 tab.

Descriptors: *Pulp wastes, *Water pollution effect, *Monitoring, Water analysis, Wastes, Industrial wastes, Water pollution sources, Canada, Foreign countries, Pulp and paper industry, Effluents, Biological properties, Hydrography, Benthic fauna, Benthic flora, Water temperature, Salinity, Turbidity, Hydrogen ion concentration, Lignins, Color, Dissolved oxygen, Surface waters, Tannin, Kraft mills, Organic matter.

Canadian Cellulose Co. Ltd., Northern Pulp Operations (Prince Rupert, British Columbia), has successfully established a continual biological (benthic analysis) and hydrographic (temperature, salinity, turbidity, pH, tannin and lignin concentration, color, and dissolved oxygen) monitoring program on its receiving waters. The program has yielded good background information and also provided

aluable data to assess the environmental impact of e kraft mill effluents. (Swichtenberg-IPC)
'79-04416

ECTION 404 OF THE FEDERAL WATER OLLUTION CONTROL ACT AMENDMENTS F 1977: HYDROLOGIC MODIFICATION, 'ETLANDS PROTECTION AND THE PHYSI-AL INTEGRITY OF THE NATION'S 'ATERS,
. Thompson, Jr.
he Harvard Environmental Law Review, Vol. 2, 264-287, 1977.

escriptors: *Federal water pollution control act, Wetlands, *Water quality, *Hydrologic systems, redging, Drainage, Regulation, ischarge(Water), Legislation, Streams, Resource evelopment, Environmental effects.

he objective of the Federal Water Pollution Con-ol Act (FWPCA) is to restore and maintain the hemical, physical and biological integrity of the ation's wates. A serious but relatively underpubli-zed threat to the quality of streams and water-eds is hydrologic modification--the conversion of etlands to dry ground through dredging and ling. Unlike chemical pollution, which tends to verse itself when ceased, hydrologic modifica-on results in the permanent alteration of the natu-l capacity of a water body to cleanse itself of ollution and to support a healthy biological stem. It has been estimated that almost half of e wetlands which once existed in the United ates have been destroyed by dredging, filling and ainage. Two FWPA provisions address the roblem of hydrologic modification. Section 208 ovides for a program of state planning and regu-tion of water pollution. Section 404 authorized e U.S. Army Corps of Engineers, in conjunction ith the federal Environmental Protection gency, to regulate discharges of dredged and fill aterials. This article traces the history of federal gulation of hydrologic modification and exam-es the implications of recent amendments to the WPCA. (Hucks-Florida)
'79-04419

I. DUPONT DE NEMOURS & CO. V. TRAIN EPA AUTHORITY TO SET INDUSTRY WIDE FFLUENT LIMITATIONS BY REGULATION,
or primary bibliographic entry see Field 6E.
'79-04439

ONPOINT SOURCE POLLUTION,
J. Lazarus.
he Harvard Environmental Law Review, Vol. 2, 176-98, 1977.

escriptors: *Water pollution sources, *Federal ater pollution control act, Pollution abatement, Vater quality control, Water pollution, Pollut-nts, Sediment control, Regulation, Land use, aste treatment, Resource management, Stand-ds.

raditionally, the focus of federal and state pollu-on control efforts have been on point source llution. Recently, however, greater emphasis has en placed on nonpoint source pollution. Non-oint source is a term applied to water pollution hich does not emanate from any 'discernible, nfined and discrete conveyance.' The principal llutant from non-point sources is sediment from osion caused by agricultural activities. Industry, ining operations and construction are also major uses of nonpoint source pollution. The Federal ater Pollution Control Act (FWPCA) is the deral government's major weapon against water llution. The FWPCA's 1977 amendments reflect e growing concern over nonpoint source pollu-on, which according to several studies, may often responsible for a greater percentage of pollution an are point sources. This article discusses the story of nonpoint source control under the WPCA, significant developments in nonpoint urce control which occurred during 1977 and ovides a brief assessment of the prospects for hieving needed nonpoint source pollution abate-ment in light of these developments. In addition to federal efforts in this area, recent developments in state pollution control are examined. (Hucks-Florida)
W79-04443

ENDOTOXIN IN WATERS OF THE STATE OF VERMONT,
Vermont Univ., Burlington. Dept. of Medical Microbiology.
W. R. Stinebring.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 283, Price codes: A03 in paper copy, A01 in microfiche. Vermont Water Resources Research Center, University of Vermont, 1978. 25 p, 5 tab, 31 ref, append. OWRT A-038-VT(1), 14-34-001-8048.

Descriptors: *Toxins, Endotoxin, Vermont, *Assay, Natural watercourses, Streams.

The micro-limulus assay used in this study is about 1/10th as costly as the standard limulus assay for determination of the endo-toxin content of certain waters of the State of Vermont. These waters varied from pristine streams high in the mountains where there is little opportunity for pollution from animal or human wastes, to rivers which serve as a major receiving waters for many of the villages and towns and cities of the State of Vermont. Findings indicate that in pristine waters there are undetectable levels of endotoxin and other waters range from barely detectable levels, i.e., 0.1 of a microgram/liter to 1000 micrograms/liter, about 5-10 LD50s for the mouse or about 10,000 pyrogenic doses for the average human. Endotoxins which are bacterial products are known to produce absorptions, produce fevers, injure tumors, stimulate the production of interferon, and cause death if administered in large enough quantities, in experimental animals into which the endotoxin has been properly administered. It is concluded that there is evidence that this potent biological toxin can be found in significant quantities in certain waters of the State of Vermont.
W79-04492

5B. Sources Of Pollution

THE COMPLEXING AND ADSORPTION OF CADMIUM IN SOILS IN THE PRESENCE OF EDTA AND NTA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
R. Fugii.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 809, Price codes: A07 in paper copy, A01 in microfiche. MS Thesis in Water Science, (1978). 112 p. 10 fig, 7 tab, 3 append. (California Water Resources Center Project UCAL-WRC-W-511). OWRT B-180-CAL(1).

Descriptors: *Cadmium, *Adsorption, *Soils, *Soil treatment, *Heavy metals, Cations, Waste disposal, Soil water, Chemistry, Soil contamination, Water pollution sources, Sewage sludge, Industrial wastes, Effluents, *Path of pollutants.

Varying solution concentrations of cadmium containing EDTA and/or NTA were applied to a Yolo silt loam at a 1:4 soil to solution ratio. The additions of chelating agents decreased significantly the total Cd adsorbed by the soil, EDTA playing a more dominant role than NTA. The Langmuir adsorption equation alone and another model coupling Langmuir adsorption and Gapon exchange adsorption describe well the adsorption of Cd on soil as influenced by 1.5 mg/l EDTA and 1.5 mg/l NTA additions at all but the highest applied Cd concentration used in the experiments. The total adsoprtion isotherm was 'S' shaped. A marked increase in total Cd adsorption occurred at the highest applied Cd concentration. At this applied concentration, the Cd(+2) concentration became significant and this species could participate in cation exchange. Thus, the extent of adsorption depends on the speciation of Cd in solution. A computer program was used to calculate the activities of the free ions and their complexes in the equilibrium solutions. In all solutions free Cd(+2) activities were insignificant. The Cd speciation was dominated by CdEDTA(-2) or DcNTA(-) (in solutions containing no EDTA additions). The concentrations of Ca and Mg complexes of NTA and EDTA were also significant.
W79-04007

TRACE ELEMENTS IN RUNOFF FROM RAINFALL AND SNOWMELT AT SEVERAL LOCALITIES IN THE DENVER, COLORADO, METROPOLITAN AREA,
Geological Survey, Denver, CO. Water Resources Div.
W. M. Alley, and S. R. Ellis.
In: Proceedings of the International Symposium on Urban Storm Water Management, University of Kentucky, Lexington, July 24-27, 1978, p 193-198, 1978. 3 fig, 8 tab, 17 ref.

Descriptors: *Water quality, *Trace elements, *Runoff, Rainfall, Snowmelt, Urban runoff, Chemical analysis, Cadmium, Chromium, Manganese, Mercury, Nickel, Copper, Iron, Lead, Zinc, Colorado, *Denver, Antimony, Lithium, Selenium, Arsenic.

Concentrations of antimony, cadmium, chromium, lithium, manganese, mercury, nickel, and selenium have been determined in selected samples of rainfall runoff from several urban localities in the Denver metropolitan area. Multiple samples collected during periods of runoff from both rainfall and snowmelt were analyzed for arsenic, copper, iron, lead, and zinc. Of these trace elements, iron, lead, and zinc were predominant in runoff from the rainfall and snowmelt, with concentrations of iron at times exceeding 10,000 micrograms per liter and with concentrations of lead and zinc at times exceeding 1,000 micrograms per liter. The concentrations of trace elements were highest during the initial parts of the periods of rainfall runoff and then decreased with time. Trace-element concentrations in snowmelt runoff generally peaked during the middle of the day, corresponding with periods of maximum melting and runoff. Instantaneous loads of trace elements were largely a function of discharge for runoff from both rainfall and snowmelt. The trace elements were predominantly in the particulate phase, with the ratio of particulate to dissolved concentrations averaging 20. Between April 1 and October 31, 1976, estimated total loads of trace elements for a 606-acre residential site were: Arsenic, 0.8 pound; copper, 4.4 pounds; lead, 44 pounds; and zinc, 23 pounds. (Woodard-USGS)
W79-04019

CONVECTIVE CONTAMINANT TRANSPORT TO PUMPING WELL,
Geological Survey, Syosset, NY. Water Resources Div.
T. E. Reilly.
Journal of the Hydraulic Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. HY12, Paper 14258, p 1565-1575, December 1978. 5 fig, 9 ref, 2 append.

Descriptors: *Path of pollutants, *Groundwater movement, *Water table, *Aquifer characteristics, *Pumping, Water wells, Drawdown, Flow rates, Finite element analysis, Flow nets, Analytical techniques, Equations, *Time of travel, *Pollutants, Dimensional analysis.

Traveltime of a contaminant from the water table to a well screen, and its concentration at the well screen at given time intervals, can be determined through a radially symmetric, idealized flow system. Dimensionless flow nets that describe the plug flow of the contaminant are developed through analysis of the two-dimensional radial continuity equation in conjunction with a finite-element simulation of the potential distribution. Results of the study are dimensionless type curves that can be used to calculate traveltimes and concentrations of the contaminant under a multitude of conditions. (Woodard-USGS)
W79-04022

HYDROGEOLOGY RELATED TO GEOTHERMAL CONDITIONS OF THE FLORIDAN PLATEAU,
Geological Survey, Woods Hole, MA. Water Resources Div., Alabama Univ., Tuscaloosa; and Coastal Petroleum Co., Tallahassee, FL.
For primary bibliographic entry see Field 2F.
W79-04033

QUALITY AND MOVEMENT OF GROUND WATER IN OTTER CREEK - DRY CREEK BASIN, CORTLAND COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-04035

MIXING IN SHALLOW COASTAL SEA: CASE STUDY,
New Jesey Dept. of Environmental Protection, Trenton. Delaware River Water Quality Planning.
S. F. Hsueh, and R. C. Ahlert.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14210, p 1293-1304, December 1978. 8 fig, 6 ref, 1 append.

Descriptors: *Estuaries, *Mixing, *Model studies, *On-site investigations, *New Jersey, Dye releases, Tracers, Tides, Tidal waters, Tidal effects, Tidal energy, Dispersion, Hydrodynamics, Water pollution, Pollutants, Path of pollutants, Coasts, Rivers, Data collections, Data processing, *Shrewsbury River(NJ).

Two tracer studies were used to characterize mixing and tidal exchange in a New Jersey coastal sea. Several dredged channels and complex flow patterns due to islands and embayments cause the system to exchange slowly and to be mixed relatively well internally. Tracer output at the mouth displayed multiple peaks, a long delay, and detectable concentrations for several days. A transient, lumped-parameter, reacter network model was calibrated with the second data set. Agreement between the model and field data was good. The simulation did not perform well with the first data set. Further, the output was relatively insensitive to input. This model is not well suited to water quality planning and management for the estuary studied. (Sims-ISWS)
W79-04049

PROJECTING URBAN RUNOFF FLOWS AND LOADS,
Basic Technology, Inc., Pittsburgh, PA.
L. Hajas, D. B. Boggs, A. J. Shuckrow, and R. G. Quimpo.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14243, p 1149-1163, December 1978. 4 fig, 3 tab, 2 ref, 1 append.

Descriptors: *Urban runoff, *Pollutants, *Water quality, *Model studies, *Pennsylvania, Mathematical models, On-site investigations, Sampling, Surveys, Monitoring, Urbanization, Cities, Rainfall, Runoff, Water pollution, Water pollution sources, Storm water, Sewers, Combined sewers, Separated sewers, Planning, Forecasting.

As part of the COWAMP/208 Areawide Water Quality Management Program for the nine-county region that constitutes Southwestern Pennsylvania, an extensive analysis of the magnitude of the urban runoff problem in the study area was carried out. As the predictive tool for estimation of runoff quantity and quality, the Army Corps of Engineers' Storage Treatment Overflow Runoff Model (STORM) was employed. In order to calibrate the model to reflect local characteristics, a field sampling program was performed in several tests basins in the study area. This paper described the design, conduct, methodology, and results of the field program as well as the use of this information in urban runoff flow and load projections. (Sims-ISWS)
W79-04050

ASSESSING NONPOINT WATER QUALITY FOR SMALL STREAMS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
M. E. Meadows, D. W. Weeter, and J. M. Green.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14232, p 1119-1133, December 1978. 6 fig, 8 tab, 21 ref, 2 append.

Descriptors: *Assessments, *Water quality, *Streams, Sampling, Surveys, Monitoring, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Model studies, Mathematical models, Land use, Streamflow, Water resources, Nonpoint water pollution.

The procedures and results of an assessment study of water quality in a small stream impacted only by nonpoint source pollution were presented. Also, considerations for the design of a small stream monitoring survey were discussed. A mathematical model for water quality in small streams was applied to the monitoring data, and estimates of the nonpoint source water quality were obtained. An attempt was made to interpret the nonpoint quality in terms of land use. (Sims-ISWS)
W79-04051

STORMWATER ANALYSIS AND PREDICTION IN HOUSTON,
Rice Univ., Houston. TX. Dept. of Environmental Science and Engineering.
P. G. Bedient, D. A. Harned, and W. G. Characklis.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14237, p 1087-1100, December 1978. 3 fig, 4 tab, 16 ref, 2 append. EPA 802433.

Descriptors: *Storm water, *Water quality, *Water pollution sources, *Texas, Surveys, Sampling, On-site investigations, Model studies, Mathematical models, Storms, Rainfall, Runoff, Streamflow, Water pollution, Pollutants, Path of pollutants, Urbanization, Urban runoff, Data processing, Simulation analysis, *Houston(TX).

Analyses of available stormwater hydrologic and water quality data for several Houston area watersheds yielded direct linear relationships between pollutant mass loading rates and cumulative storm runoff volume. These relationships then were used to rank the watersheds on a pollutant load per unit runoff basis and to calculate total annual pollutant loads for each area. Further, a plot of dimensionless cumulative flow versus the dimensionless cumulative flux provides a quantifiable means to evaluate the first flush, allowing comparison of this effect between watersheds. Finally, the developed load-runoff relationships provide the basis for a simple, yet effective, method of predicting pollutant mass flows for individual or sequential storm events. (Sims-ISWS)
W79-04052

JUNE 1976 POLLUTION OF LONG ISLAND OCEAN BEACHES,
State Univ. of New York at Stony Brook.
R. L. Swanson, H. M. Stanford, J. S. O'Conner, S. Chanesman, and C. A. Parker.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14238, p 1067-1085, December 1978. 6 fig, 3 tab, 21 ref, 1 append.

Descriptors: *Beaches, *Pollutants, *Water pollution, *New York, Oceans, Shores, Harbors, Sewage, Waste disposal, Path of pollutants, Water pollution sources, Combined sewers, Waste dumps, Landfills, Waste disposal, Municipal wastes, *Beach pollution.

In June 1976, Long Island's ocean beaches were inundated with floating wastes, including sewage-related material, trash, and garbage. The material exited the Hudson-Raritan estuary as a result of high spring runoff and intensive May rains. Once introduced into New York Bight waters, it was transported to the beaches by persistent southerly winds. The major sources of the floatable wastes were urban runoff and a sewage treatment plant bypassing feeding through the combined sewer system. Assessment was accomplished by comparing waste materials found on the beaches with the types and volumes of materials associated with suspected sources. Continual washups of floatable material can be expected, particularly during summer months, until better source and screening control are implemented. (Sims-ISWS)
W79-04053

THE EFFECT OF ICE COVER ON VERTICAL TRANFER IN STREAM CHANNELS,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W79-04062

AMMONIA IN TEXAS STREAMS DURING LOW FLOW FROM MUNICIPAL WASTEWATER,
Texas Univ. Health Science Center at Houston. School of Public Health.
E. M. Davis, T. D. Downs, and W. G. Gray.
Water Resources Bulletin, Vol. 14, No. 6, p 1417-1422, December 1978. 1 fig, 1 tab, 8 ref.

Descriptors: *Ammonia, *Toxicity, *Waste water(Pollution), *Texas, Fish toxins, Pollutants, Nitrogen, Nitrates, Nitrites, Municipal wastes, Effluents, Streams, Streamflow, Data processing, Water quality, Water pollution, Water pollution sources.

An investigation of treated municipal wastewaters discharged into Texas streams was conducted to determine the probable effect of concentrations of ammonia in receiving waters. The investigation was based on existing data on ammonia levels which are lethal to various species of fish. Recorded data for most Texas cities were analyzed. Based on existing toxicity criteria for ammonia of 1/10 TL sub m = 0.31 mg/l NH3-N, employing known discharge flow rates, and 7-day, 5-year or 7-day, 10-year low flows in Texas streams, appreciable numbers of sites were found to pose a threat to various species of fish. Using the bluegill as a median tolerance limit species, data from 65 cities which met the aforecited requirements were analyzed. The requirements included a total of 92 wastewater effluents. Sixty-nine percent of those cities and 70% of their effluents exceeded the 0.31 mg/l NH3-N limit in the stream below the discharge point; 37% of the cities equaled or exceeded the 96-hour TL sub m concentration limit of 3.1 mg/l ammonia. Based on the 10 mg/l NO3-N standard for intake water for potable supplies, 32% of the effluents resulted in a stream concentration which exceeded 10 mg/l, assuming a straight conversion of NH3-N to NO3-N. (Sims-ISWS)
W79-04063

A MODEL OF THE BEHAVIOR OF PH DETERMINING PARAMETERS IN IMPOUNDMENTS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
R. A. Chadderton, and R. M. Shane.
Water Resources Bulletin, Vol. 14, No. 6, p 1357-1373, December 1978. 6 fig, 2 tab, 10 ref.

Descriptors: *Hydrogen ion concentration, *Model studies, *Reservoirs, Mathematical models, Computer models, Acids, Mine acids, Mine water, Acid mine water, Coal mines, Carbon dioxide, Impoundments, Lakes, Alkalinity, Water quality, Pollutants, Water pollution, *Loyalhanna Creek Reservoir.

A computer model capable of describing the behavior of pH-determining parameters in an impoundment was presented. The steady-state model based upon principles of water chemistry, applied the complete-mix concept to the routing of the chemical quantities, alkalinity, and CO2-acidity. An iterative procedure was used to account for surface mass transfer of carbon dioxide. A fourth

gree polynomial was solved for the hydrogen concentration at each point of routed alkalinity CO2-acidity concentrations. Field data re-red to verify and apply the model were de-ibed, including an example application to the yalhanna Creek Reservoir. (Sims-ISWS)
9-04064

DIUM-226 IN GROUND WATER OF WEST NTRAL FLORIDA,
ice of Radiation Programs, Las Vegas, NV.
F. Kaufmann, and J. D. Bliss.
ter Resources Bulletin, Vol. 14, No. 6, p 1314-0, December 1978. 8 fig, 22 ref.

scriptors: *Radium, *Groundwater, *Phos-ates, *Florida, Sampling, Surveys, Water pollu-n, Water pollution sources, Water quality, uifers, Data processing, Statistics, Mining, ter table, Wells, Water wells, *Phosphate de-its, *Central Florida.

ncipal U.S. phosphate production is from cen- Florida where mining, processing, and waste posal practices intimately associate the industry h water resources. Available radium-226 data m 1966 and from 1973-1976 in mined and un-ned mineralized areas and nonmineralized areas he primary study area, Polk, Hardee, Hillsbor-gh, Manatee, and De Soto counties, were stud- using log-normal probability plots and nonpara-tric statistical tests for significant difference as ctions of time, depth, and location. Plots of ium in the water table and Floridan aquifers for neralized and nonmineralized areas indicate that ther phosphate mineralization nor the industry a probable factor. For the Lower Floridan ifer, three separate radium populations are indi-ed with geometric means of 0.7, 3, and 10 pCi/l. ometric mean radium-226 content of the water le aquifer is 0.17 pCi/l. Radium in the Floridan ifer in Manatee and Sarasota Counties is elevat-relative to that in the water table and in other as of Florida. For Sarasota County, geometric an radium content of the water table is 15 pCi/l 7.5 pCi/l in the Floridan. Potential sources lude shallow phosphate sediments, monazite ds, and possibly crystalline basement rocks or er strata unrelated to phosphatic zones of cur-t economic interest. The existing radium-226 a base is rather marginal in terms of number and tial distribution of analyses, particularly for the ter table and Upper Floridan aquifer. Existing ium data do not substantiate widespread con-ination of groundwater as a result of the phos-ate industry. However, local contamination as-iated with specific operations has occurred. ms-ISWS)
9-04065

STRIBUTION OF AUTOTROPHIC NITRI-ING BACTERIA IN A POLLUTED RIVER HE PASSAIC),
ok Coll., New Brunswick, NJ. Dept. of Envi-mental Science.
A. Matulewich, and M. S. Finstein.
plied and Environmental Microbiology, Vol. No. 1, January 1978. p 67-71, 4 tab, 14 ref. VRT A-030-NJ(5).

scriptors: *Water pollution, Waste ter(Pollution), Rivers, *Passaic River(NJ), Bac-ia, Nitrification, Nitrates, Sediments, Ammonia, ew Jersey, *Nitrifying bacteria.

e nitrification component of a proposed waste d allocation scheme for the Passaic River was allenged by a regional planning group on the is that the sequence of nitrogen transformations aracteristic of nitrification is not observed with wnstream progression. Investigation of the dis-bution of nitrifying bacteria in the river showed t, on the average, nitrifying bacteria were most merous in association with the rooted aquatic nts, followed by rock scrapings, algae, and sur-e sediment. Ammonium oxidizers in the surface diment outnumbered those in the water by a tor of 540 and nitrite oxidizers did so by 250. nmonium oxidizer most-probable-numbers PNs) were highest from approximately 2 to 5 cm, decreasing thereafter. Nitrite oxidizers decreased sharply in number at depths greater than 10 cm. The presence of higher nitrate levels in surface sediment than in water suggests that the sediment is a relatively active site of nitrification. (Chilton-ORNL)
W79-04070

DISTRIBUTION OF ARSENIC IN SOIL PROFILES AFTER REPEATED APPLICATIONS OF MSMA,
Auburn Univ., AL. Dept. of Soils.
A. E. Hiltbold, B. F. Hajek, and G. A. Buchanan.
Weed Science, Vol. 22, No. 3, p 272-275, May 1974. 1 fig, 3 tab, 12 ref. OWRT A-027-ALA(1).

Descriptors: *Arsenic, Soil leaching, *Monosodium methanearsonate, MSMA, Soil profiles.

Arsenic as MSMA (monosodium methanearsonate) was applied to three soil types over a 6-year period. Percentage recovery of applied arsenic averaged 67, 57, and 39% in Hartsells fine sandy loam, Decatur silt loam, and Dothan loamy sand soils, respectively. Essentially all of the arsenic recovered in the soils occurred in the plow layer with no evidence of leaching into deeper zones. Batch-equilibrium and soil-column studies in the laboratory indicated that the rate of MSMA movement through the surface horizon would be fastest in Dothan loamy sand and slowest in Decatur silt loam.
W79-04085

THE ROLE OF STREAMS IN POLLUTION DILUTION AND DISPERSION,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
H. Silva, and J. F. Harp.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 935, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute. Oklahoma State University, Stillwater. Technical Completion Report, September 1978. 42 p, 7 fig, 4 tab, 6 ref. OWRT-A-083-OKLA(1).

Rock Creek at Sulphur, Oklahoma, was studied to determine the existing water quality, and to measure water quality of selected points along the stream. A description of the Rock Creek watershed area includes a discussion on beneficial uses and water quality, a hydrological description of the creek, and sources of pollution to the creek. A discussion of mathematical modeling of natural water bodies is followed by the presentation of mathematical models for the three sampling stations, 7, 14, and 18. Mathematical modeling was developed in two phases. Phase 1 is based on data obtained from an earlier study, and included data for dissolved oxygen (DO), fecal coliform, organic nitrogen, and total phosphorus for each of the three stations. In phase II data was obtained to develop models for DO, organic nitrogen, and total phosphorus. Each model with its statistical analysis for validity is presented. It is concluded that modeling of the stream is statistically accurate, and that simulation of different conditions is reliable. High concentrations of phosphorus shown during the study are thought to be unique to this stream at this time; nitrogen concentrations were below the applicable standards. (Davison-IPA)
W79-04118

SOUTH PLATTE RIVER BASIN ACCOMPLISHMENT PLAN.
Environment Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 5G.
W79-04145

A RATIONAL APPROACH FOR OPTIMIZING APPLICATION RATES OF FERTILIZER NITROGEN TO REDUCE POTENTIAL NITRATE POLLUTION OF NATURAL WATERS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
B. Singh, C. R. Biswas, and G. S. Sekhon.
Agriculture and Environment, Vol. 4, No. 1, p 57-64, April, 1978. 3 fig, 2 tab, 6 ref.

Descriptors: *Nitrogen, *Fertilizers, Nitrates, *Water pollution sources, Wheat, Sweet corn, Crop response, Leaching, Crop production.

Yield, N uptake and residual NO3(-)-N data for wheat and maize, raised in a long-term experiment, have been discussed to determine optimum rates of fertilizer N aplication at which yeilds are least affected, while unused nitrogen, whch is a potential pollutant, is reduced to a permissible level. Computation of fertilizer N rates corresponding to the points of greatest economic return and permissible N loss has been described. Optimum fertilizer N rate is the smaller of the two fertilizer N rates. By assuming a loss of 60 kg N/ha or less, as environmentally permissible, it was observed that a small yield increment of maize would have to be sacrificed for the protection of the enivronment; whereas, for wheat, nitrogen can be applied safely up to the point of greeatest economic return. Coincidence of the rainy season with the growth period of maize in the study area seems to have reduced the fertilizer N rate, corresponding to the point of permissible N loss, lower than that for greatest economic return. (Skogerboe-Colorado State)
W79-04162

NON-POINT POLLUTION AND THE SCS,
For primary bibliographic entry see Field 6E.
W79-04197

EFFECTS OF EVAPORATIVE SALT WATER COOLING TOWERS ON SALT DRIFT AND SALT DEPOSITION ON SURROUNDING SOILS,
Texas Agricultural Experiment Station, College Station.
R. P. Wiedenfeld, L. R. Hossner, and E. L. McWilliams.
Journal of Environmental Quality, Vol. 7, No. 2, p 293-298, April-June, 1978. 5 fig, 2 tab, 15 ref.

Descriptors: *Cooling towers, *Saline water, Saltation, Environmental effects, Texas, Evaporation, *Soil contamination.

Five salt water cooling towers recently constructed near Galveston Bay, Texas have been shown to contribute to salt deposition in the surrounding area. Levels as high as 1,200 kg/ha per year of total salt were encountered within 100 m of the towers, but decreased in a logrithmic fashion with distance to $<$300 kg/ha per year at 434 m with only 16% attributable to the cooling towers. The remaining deposition was caused by natural sea spray which varies widely but average about 250 kg/ha per year in the study area. Changes in composition of air-borne salts with distance from the cooling towers were noted, primarily as a narrowing of the Na/Ca ratio. Salinity levels in the soil are in equilibrium with naturally deposited salts. Enhanced salt deposition levels due to the cooling towers initially caused only slight effects in the soils closest to the towers, but may eventually lead to both salinization and solonization in the surrounding vicinity. (Skogerboe-Colorado State)
W79-04220

A STUDY OF THE FATE OF SUSPENDED SOLIDS FROM A FULL-SCALE TREATMENT PLANT IN RECEIVING WATERS,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
H. S. Costa, D. L. Borton, and J. J. McKeown.
NCASI Stream Improvement Technical Bulletin No. 313, June, 1978. 44 p, 8 fig, 10 tab, 20 ref, 1 append.

Descriptors: *Pulp wastes, *Suspended solids, Wastes, Industrial wastes, Water pollution sources, Pulp and Paper industry, Effluent, Oxidation ponds, Aerated lagoons, Surface waters, Sediments, Invertebrates, Carbon radioisotopes, Oxidation, Carbon dioxide, Food chains, Board mills.

Carbon 14-labeled glucose was added to the 10-day aerated stabilization basin at a boxboard mill in order to trace the fate of suspended biosolids in the effluent discharged to a stream. Sediment traps placed in pools behind dams (where earlier studies found no discernible bottom deposits) captured less than 4% of the discharged solids. Over 96% of the discharged solids remained suspended or were oxidized in this stream whose velocities were less than an order of magnitude lower than normally associated with scouring of organic particles. Macroinvertebrates recovered from the rapidly flowing and completely mixed sections of the stream between pools contained measurable quantities of carbon-14. Residual biosolids were ingested and then incorported into the cellular materials of aquatic food chain organisms. Oxidation followed by release of carbon dioxide to the atmosphere is believed to be the major sink for total suspended solids discharged from biological treatment systems. (Swichtenberg-IPC)
W79-04225

TRITIUM TRACING OF UNSATURATED MOISTURE MOVEMENT,
Clemson Univ., SC. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W79-04266

SIMAZINE RESIDUES IN CANAL WATER AND CROPS RESULTING FROM EXPERIMENTAL APPLICATION FOR DITCHBANK WEED CONTROL,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. C. Pringle, L. W. J. Anderson, N. E. Otto, R. W. Raines, and U. T. Jackson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 173, Price codes: A03 in paper copy, A01 in microfiche. Report No. REC-ERC-78-1, May 1978. 33 p, 38 fig, 7 tab, 23 ref, 2 append.

Descriptors: *Pesticide residues, *Path of pollutants, *Simazine, Herbicides, Movement, Pesticide kinetics, Soil contamination, Water pollution, Food chains, Canals, On-site tests, Weed control, Irrigation, Irrigation effects.

Canals in California, Colorado, and Washington State were selected for a field study to determine the amount of simazine likely to be found in irrigation water following ditch bank treatment for weed control. Simazine was applied to both watered and dewatered sites at rates of 2.25 kg/ha (2 lb/acre) and 4.5 kg/ha (4 lb/acre). Immediately after the application, simazine levels detected in flowing canal water did not exceed 60 micrograms/L. The following spring first flow samples collected from the dry application sites peaked at 250 micrograms/L within the treated section, but dropped to less than 5 micrograms/L. In a correlated study six crops were irrigated with water containing 0.01 and 0.1 micrograms of simazine and harvested seven and 30 days after treatment. Trace amounts of herbicide were found in sugar beets, corn foliage, and tomatoes. Larger amounts were found in sugar beet foliage, and alfalfa contained the largest amounts of residue of the crops tested. No simazzine residue was found in corn grain, pinto bean pods and foliage, and cucumbers. According to a literature review, crop and canal water residue levels resulting from the experimental applicaton of simazine to inside slopes of canal banks were within established tolerance for potable water, and would produce no significant impact on crops and nontarget aquatic organisms. (Davison-IPA)
W79-04267

SALINITY EFFECTS ON GROWTH AND TOXIN CONTENT OF GONYAULAX EXCAVATA, A MARINE DINOFLAGELLATE CAUSING PARALYTIC SHELLFISH POISONING,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
A. W. White.
Journal of Phycology, Vol. 14, p 475-479, 1978. 3 fig, 17 ref.

Descriptors: *Growth rate, Dinoflagellate, Phytoplankton, *Salinity, *Toxicity, *Public health, Commercial shellfish, Gonyaulax, Saxitoxin, Toxin content, Laboratory tests, Growth curves.

The optimum salinity for growth of Gonyaulax excavata from Cape Ann, Massachusetts, is 30.5%, and it grows well over a range of 20-40%. It tolerates salinities of 11-43%. Growth rates at 24 and 20% are only ca. 10 and 20% less, respectively, than the maximum, 0.36 divisions/day. It is considered unlikely that salinity fluctuations in the coastal areas where this organism occurs significantly influence its growth rate. The paralytic toxin content in G. exacavata increases with increasing salinity, up to 37%. Therefore, the degree of toxicity of the organism in nature may be influenced by this environmental factor. (Katz-EIS)
W79-04313

FIRTH OF FORTH OIL POLLUTION INCIDENT, FEBRUARY 1978,
Royal Society for the Protection of Birds Sandy (England).
L. H. Campbell, K. T. Standring, and C. J. Cadbury.
Marine Pollution Bulletin, Vol. 9, p 335-339, 1978. 3 fig, 4 tab, 8 ref.

Descriptors: *Oil spills, *Waterfowl, *Toxicity, Mortality, Ducks(Wild), Water birds, Animal groupings, Animal behavior, Oil pollution, Oil, Fuels, Gulls, Organic compounds, Sewage treatment, *Crude oil.

Where seaducks and other waterfowl are highly concentrated, even small quantities of oil can be a major hazard. A pollution incident on the Firth of Forth in February 1978 was notable in that it affected 241 Great Crested Grebes as well as 700 diving ducks. Evidence is provided indicating that the slick passed close to the main wildfowl feeding area at night, oiling noctural-feeding Scaup and Pochard and a raft of roosting grebes, while Eider and Goldeneye, which had moved elsewhere to roost, largely escaped. The behaviour of freshly oiled birds is described. Heavily oiled Pochard flew 7 km inland to a loch before they were incapacitated. This is the sixth oil pollution incident to affect a large number of birds on the Forth since January 1970. (Deal-EIS)
W79-04316

THE INFLUENCE OF SALINITY ON TOXICITY OF CADMIUM AND CHROMIUM TO THE BLUE CRAB, CALLINECTES SAPIDUS,
Kelly High School Beaumont, TX.
For primary bibliographic entry see Field 5C.
W79-04319

EFFECT OF PCBS AND OTHER ORGANOCHLORINE COMPOUNDS ON THE HATCHABILITY OF ATLANTIC SALMON (SALMO SALAR) EGGS,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
For primary bibliographic entry see Field 5C.
W79-04320

BIOMAGNIFICATION OF HEAVY METALS BY ORGANISMS IN A MARINE MICROCOSM,
Texas Univ. Health Science Center at Houston. School of Public Health.
R. K. Guthrie, E. M. Davis, D. S. Cherry, and H. E. Murray.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 53-61, 1979. 3 tab, 10 ref.

Descriptors: *Food webs, *Path of pollutants, Oysters, Clams, Crabs, Bottom sediments, Water chemistry, Metals, Heavy metals, Biological communities, Iron, Zinc, Manganese, Cadmium, Copper, Chromium, Mercury, Water analysis, Chemical analysis, *Bioaccumulation, *Tissue analysis, *Barium, *Selenium, *Arsenic, *Polychaete, *Barnacles.

The objective was to study possible pathways of bioaccumulation by determining the relative bioaccumulation of ten selected, potentially toxic metals by the marine organisms comprising limited microcosms in two Texas bays. Concentrations of metals were measured in bay water, sediment, barnacle, crab, oyster, clam and polychaete. With the exception of Cu and Cd, barnacles had the highest concentration of each metal. Polychaetes most readily biomagnified Cd and Cu. The biomagnification of Zn, Cu and As by oysters in these environments may be hazardous to man. Clams appear to be very similar to oysters in biomagnification of metals in these microcosms. Crabs appear to be least likely to biomagnify the metals studied. (Deal-EIS)
W79-04322

INCREASE IN THE HUMAN BLOOD PCB LEVELS PROMPTLY FOLLOWING INGESTION OF FISH CONTAINING PCBS,
Osaka Prefecture Inst. of Public Health (Japan). Lab. of Food Chemistry.
K. Kuwabara, T. Yakushiji, I. Watanabe, S. Yoshida, and K. Yoyama.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 273-278, 1979. 4 fig, 11 ref.

Descriptors: *Polychlorinated biphenyls, *Animal physiology, *Foods, Chemical analysis, Path of pollutants, Animal metabolism, Gas chromatography, Pesticide residues, Pesticide kinetics, Lipids, Public health, *Tissue analysis.

Two human subjects ingested commercially obtained cutlass fish and immature yellowtail which had a known PCB contamination level. Blood levels of PCBs were monitored before and at intervals after ingestion. Within 3-5 hours after ingestion the levels of PCB rose to 1.5 and 1.6 times preingestion levels in the two subjects. Serum PCB levels returned to preingestion levels 24 hours after ingestion. (Deal-EIS)
W79-04326

FURTHER STUDIES ON BIFIDOBACTERIA AS INDICATORS OF FAECAL POLLUTION IN WATER,
Newcastle-upon-Tyne Univ. (Great Britain). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W79-04328

ELUTRIATE-PRIMARY PRODUCTIVITY BIOASSAYS OF DREDGE SPOIL DISPOSAL IN LAKE ERIE,
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
R. W. Flint, and G. J. Lorefice.
Water Resources Research, Vol. 14, No. 6, p 1159-1163, 1978. 2 fig, 2 tab, 14 ref.

Descriptors: *Dredging, *Primary productivity, *Lake Erie, Bioassay, Sediments, Particle size, Suspended solids, Photosynthesis, Algae, Water Analysis, Sediment discharge, Radioactivity techniques, Analytical techniques, *Elutriate.

The standard sediment elutriate procedure was combined with radioactive primary productivity methods to evaluate impacts of dredged material disposal on pelagic primary producers. Several treatment levels suggested that dredged material disposal inhibited algal photosynthesis at higher concentrations. The procedure developed reflected the 'bioavailability' of dissolved constituents released during deposition. The results also implied that particle formation within the water column during disposal may promote microbial (heterotrophic) growth. The procedure described is especially valuable in evaluating pelagic effects of dredged material disposal because of its use of natural populations, minimal expense, and, most importantly, short experimental duration compared to that of standard laboratory bioassays. (Deal-EIS)
W79-04329

ELATIONSHIP BETWEEN INDICATOR OR-
ANISMS AND SELECTED PATHOGENIC
ACTERIA IN URBAN WATERWAYS,
hns Hopkins Univ., Baltimore, MD Environ-
ental Health.
or primary bibliographic entry see Field 5A.
79-04330

CCURRENCE OF TOXIC BIVALVES IN AS-
OCIATION WITH GONYAULAX PLANK-
ONS IN ISE, OWASE, AND OFUNATO BAYS,
okyo Univ. (Japan). Faculty of Agriculture.
Noguchi, R. Adachi, M. Iguchi, H. Kamiya,
d K. Hashimoto.
lletin of the Japanese Society of Scientific Fish-
ies, Vol. 44, No. 11, p 1245-1248, 1978. 1 fig, 3
o, 7 ref.

escriptors: *Eutrophication, *Bivalves, *Toxic-
, Clams, Mussels, Plankton, Poisons, Chemical
alysis, Dinoflagellates, Commercial shellfish,
blic health, Human pathology, Hazards, *Gon-
ulax, *Tissue analysis, *Scallop, *Shellfish
ison.

he occurrence of toxic bivalves was surveyed in
veral bays. Various bivalves, such as short-
cked clam and mussel, collected in April and
ay, 1976, in Ise Bay showed a maximum toxicity
100 MU/g of whole soft body. The mussel
llected in January and February, 1977, in Owase
ay exhibited a maximum toxicity of 70 MU/g of
hole soft body. In the former case, a Gonyaulax
oom occurred almost in parallel with the appear-
ce of toxic bivalves, indicating their close associ-
on. In the latter case, no bloom was observed.
n the other hand, as high toxicity as 800 MU/g
as encountered with the mid-gut gland of scallop
llected in May, 1976, in Ofunato Bay where no
sible Gonyaulax bloom has so far been observed.
he toxicity values of the ovary and adductor
uscle of scallop were 45 and 20 MU/g, respec-
ely. The possible relationship of toxic bivalves
d Gonyaulax blooms was discussed. (Deal-EIS)
79-04331

EHAVIOR OF MERCURY IN BIOSYSTEMS.
I. BIOTRANSFERENCE OF MERCURY
HROUGH FOOD CHAINS,
eorgia Univ., Athens. Dept. of Food Science.
. K. Hamdy, and N. V. Prabhu.
lletin of Environmental Contamination and
oxicology, Vol. 21, p 170-178, 1979. 3 fig, 1 tab,
ref.

escriptors: *Mercury, *Food chains, *Absorp-
on, Trophic level, Bacteria, Mosquitoes, Cichlids,
arval growth stage, Radioactivity, Techniques,
racers, Cytological studies, Chemical analysis,
ath of pollutants, *Tissue analysis, *Bioaccumula-
on, *Biotransference, *Methylmercury, *Gup-
es.

his study was conducted to follow the biotrans-
rence of radioactive mercury in a simple model
od chain which consisted of four trophic levels:
om mercury resistant bacteria to mosquito larvae;
en from larvae to guppies (small fish); and finally
om guppies to Cichlids (big fish). It was observed
at 203HG+2 is concentrated by two of the
ganisms used, namely the lower system (i.e. the
cterial cells and the larvae). These are the only
stems that exhibited magnification of mercury in
is study. The results obtained also showed that
e concentration factors of the inorganic and or-
nic mercury compounds via biotransference
ere different in the various trophic levels used.
Deal-EIS)
79-04334

ETHYLATED MERCURY IN BROOK
ROUT (SALVELINUS FONTINALIS): AB-
ENCE OF AN IN VIVO METHYLATING
ROCESS,
ak Ridge National Lab., TN.
W. Huckabee, S. A. Janzen, B. G. Blaylock, Y.
almi, and J. J. Beauchamp.
ransactions of the American Fisheries Society,
ol. 107, No. 6, p 848-852, 1978. 3 tab, 18 ref.

Descriptors: *Mercury, *Brook trout, *Fish physiology, Animal metabolism, Biochemistry, Path of pollutants, Gas chromatography, Chemical analysis, Growth rates, Food habits, Food chains, Absorption, *Tissue analysis, *Methylmercury, *Mercury compounds, *Bioaccumulation.

The possibility of in vivo conversion of inorganic mercury to MeHg in brook trout was tested by chronically exposing fish to mercury (from Hg(NO3)2) at a concentration of 1 ng/ml, for 56 days, and then maintaining them at background levels for 294 days. The concentrations of inorganic and methylated mercury (MeHg) in several organs of control and test fish were periodically measured over this 50-wk period. The inorganic mercury levels in test fish increased rapidly during exposure. The MeHg concentrations in both control and test fish increased slowly and at the same rate, with final 350-day concentrations comparable to levels found in wild brook trout from an uncontaminated area. This information indicates that fish do not methylate inorganic mercury in vivo, and that approximately one-half of the MeHg body burdens in the fish was acquired via the food. (Deal-EIS)
W79-04335

THE RELATIVE CONTRIBUTIONS OF METHYLMERCURY FROM FOOD OR WATER TO RAINBOW TROUT (SALMO GAIRDNERI) IN A CONTROLLED LABORATORY ENVIRONMENT,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
G. R. Phillips, and D. R. Buhler.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 853-861, 1978. 3 fig, 2 tab, 30 ref.

Descriptors: *Rainbow trout, *Mercury, *Path of pollutants, Fish behavior, Fish physiology, Absorption, Growth rates, Food habits, Water chemistry, Chemical analysis, Water quality standards, Animal metabolism, Heavy metals, *Tissue analysis, *Mercury compounds, *Methylmercury, *Bioaccumulation.

Rainbow trout accumulated methylmercury linearly during 24 days when continually exposed to methylmercury. Exposure was by means of water solutions (0.07-1.33 microg Hg/liter), food consumption (8.0-380.5 ng Hg/g fish per day) or both. Methylmercury accumulated from one source had no influence on the rate of uptake from the second source. Methylmercury accumulated from both sources was quantitatively additive, which validates a frequently used assumption. Food consumption rate and therefore growth rate had no influence on the rate of mercury accumulation from water. Nearly 70% of the methylmercury ingested and 10% of the methylmercury passed over the gills was assimilated. (Deal-EIS)
W79-04337

TOXICITIES OF CADMIUM, COPPER, AND ZINC TO FOUR JUVENILE STAGES OF CHINOOK SALMON AND STEELHEAD,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
For primary bibliographic entry see Field 5C.
W79-04339

ACUTELY LETHAL LEVELS OF CADMIUM, COPPER, AND ZINC TO ADULT MALE COHO SALMON AND STEELHEAD,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
For primary bibliographic entry see Field 5C.
W79-04340

TOXICITY OF TEXTILE WASTE TO SOME TELEOST FISHES,
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
For primary bibliographic entry see Field 5C.
W79-04341

PREDICTING LONGITUDINAL DISPERSION OF POLLUTANTS IN RIVERS,
Missouri Univ.- Columbia. Dept. of Civil Engineering.
H. Liu, and J. E. Dieter, III.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 136-143, 1977. 4 fig, 16 ref. OWRT A-094-MO(3).

Descriptors: Dispersion, *Pollutants, *Rivers, *Forecasting, Analytical techniques, Data collections, Canals, Streams, Flumes, Laboratory tests, Channel flow, Flow characteristics.

The crux in predicting the concentration of pollutants in rivers over long distances is how to determine the one-dimensional dispersion coefficient D (also called 'the longitudinal dispersion coefficient') of each river. At present, cumbersome and expensive tracer dilution measurements must be made in field before the magnitude of D for each case can be determined with reasonable accuracy. Since D varies widely not only from river to river and from one reach to another of the same river, but also from one discharge to another even for the same reach, it is impractical to rely solely on dye dilution studies for the determination of D. In 1977, Liu reported a method to predict the longitudinal dispersion coefficient of rivers and streams with an accuracy far exceeding the contemporary simple methods. Although existing data seem to suggest an improvement in predicting the dispersion coefficient, the present paper should be viewed as a progress report of ongoing research. (See also W77-05803 and W79-04351) (Humphreys-ISWS)
W79-04365

MODELING DISSOLVED OXYGEN IN THE NEAR-FIELD,
Tulane Univ., New Orleans, LA. Dept. of Civil Engineering.
B. A. Benedict.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 144-151, 1977. 2 tab, 12 ref.

Descriptors: *Dissolved oxygen, *Forecasting, *Dispersion, Diffusion, Distribution, Jets, Mixing, Rivers, Lakes, Water quality, Oxygen sag, Methodology, Near-field models.

The oxygen resources of a body of water usually are taken as a critical indicator of the quality of that water body. A discharge of material with an oxygen demand (expressed as biochemical oxygen demand, or BOD) may be very damaging to the oxygen resources of the receiving water body. Assessing the environmental impact of such a discharge requires an analysis of the behavior of these discharges and the resulting dissolved oxygen (DO) distribution in the receiving water. The model discussed is a preliminary version, and work is underway to study further the processes of mixing and to improve the model. Included were attempts to account for re-entrainment due to interaction with the near and far shores, improved treatment of the zone of flow establishment, and a linking of the jet model to diffusion models to carry the calculations downstream after jet behavior ceases. (See also W79-04351) (Humphreys-ISWS)
W79-04366

DYNAMIC STREAMFLOW-TEMPERATURE SIMULATION APPLIED TO THE BRAZOS-LITTLE RIVERS, TEXAS,
Utah Water Research Lab., Logan.
D. S. Bowles, D. L. Fread, and W. J. Grenney.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 269-279, 1977. 3 fig,

2 tab, 13 ref. UWRL WG 156.

Descriptors: *Water temperature, *Streamflow, *Model studies, *Texas, Water quality, Mathematical models, Hydrographs, Heat balance, Analytical techniques, Analysis, *Brazos River(TX), *Little River(TX), Thermograms.

Coupled dynamic streamflow and stream temperature models (DNRT-DSTEMP) were developed and applied. The results showed that surface heat exchange is more important than lateral inflow heat exchange in the heat balance of reach 13 of the Brazos River during the December 1972 flood. At present, the estimation of lateral inflow thermograms is mainly the result of intuitive guesses and trial-and-error matching of observed and predicted thermograms after the nonadvective heat transfer process is calibrated. An independent verification of the model is difficult because of the diverse characteristics of lateral inflow thermograms associated with different floods. Therefore, it would be necessary to perform a new trial-and-error estimation of the lateral inflow thermogram for each flood simulated. Thermograms for lateral inflows could be generated by linkage with a two-dimensional hydrology-water temperature model. DNRT-DSTEMP appears to be a very flexible tool for the dynamic simulation of streamflow-stream temperature. The coupled models are suitable for aplication in temperature simulation on small streams or large river systems. Dynamic aspects of the flow and temperature variations, such as those simulated by DNRT-DSTEMP, are essential to obtain predictions of critical, but transient, stream temperature conditions that may endanger aquatic environments. (See also W79-04351). (Humphreys-ISWS)
W79-04379

DIFFUSION OF DREDGED MATERIAL IN THE MISSISSIPPI RIVER,
Army Engineer District, New Orleans, LA.
C. Grimwood, and B. A. Benedict.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 313-319, 1977. 3 fig, 2 ref.

Descriptors: *Dredging, *Mississippi River, *Louisiana, *Dispersion, Sediment transport, Dissolved solids, Pollutants, On-site investigations, Monitoring, Water quality, Sampling, Mixing, Distribution, Mathematical models, *New Orleans(LA), Dredged material.

The objective of this investigation was to determine how the fate of the material released by a hydraulic cutterhead dredge in the immediate vicinity of the discharge during dredging operations in the New Orleans Harbor fits a simple mathematical diffusion model in the immediate vicinity of the discharge pipe. The observed concentration profiles of total and dissolved constituents showed that the effect of the dredge effluent on the concentration of the constituents considered is very short lived, and im most cases, completely disappears at distances greater than 60 feet downstream from the pipe. The use of a simple, one-dimensional model of the diffusion process can approximate reasonably, with some assumptions, the rate of reduction in concentration for some materials as a function of downstream distance from the pipe. The vertical and lateral distribution of different constituents in the immediate vicinity of the pipe changes considerably from one material to another. This difference in behavior from one material to another suggests that much more experimental work needs to be done to model adequately the behavior of the specific constituent considered. (See also W79-04351)(Humphreys-ISWS)
W79-04384

EFFECTS OF AMBIENT CURRENT AND DENSITY STRATIFICATION ON BUOYANT JETS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resource.
S. J. Wright.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 336-343, 1977. 4 fig, 2 tab, 7 ref. NSF GK-35774X, ENG 75-02985.

Descriptors: *Jets, *Model studies, *Spatial distribution, *Flow characteristics, Water quality, Density stratification, Laboratory tests, Analytical techniques, Outlets, Dimensional analysis, Hydraulic models, Buoyant jets, Plumes.

This presentation considered the vertical discharge of a round, turbulent buoyant jet into a ambient fluid with a uniform horizontal velocity and a linear density stratification. This flow configuration is similar to the release of various pollutants to the environment. Examples include smoke plumes from industrial chimneys, cooling tower plumes, and sewage discharges from a single port into the ocean or other body of water. The asymptotic solutions developed by the simplified flow descriptions and dimensional analysis were observed to represent adequately the characteristic behavior of buoyant jets. This includes jet trajectories in an unstratified flow, characteristic dilutions, and maximum and equilibrium heights of rise for stratified cross-flows. An important observation is that the constants predicted by the analysis were found to depend upon other parameters not considered in the simplified flow descriptions. This variation can be taken as a minor adjustment to the basic model and can be anticipated by dimensional reasoning. The general model can be used along with the experimentally measured values of the coefficients to predict flow properties which may be of interest in the design of buoyant jet discharges to release various pollutants to the environment. (See also W79-04351)(Humphreys-ISWS)
W79-04387

TIME OF TRAVEL OF SOLUTES IN LOUISIANA STREAMS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. J. Calandro.
Louisiana Department of Public Works Water Resources Technical Report No. 17, 1978. 32 p, 19 fig, 1 tab, 10 ref.

Descriptors: *Path of pollutants, *Flow rates, *Tracers, *Louisiana, *Streams, Tracking techniques, Fluorescent dye, Mathematical models, Estimating, Equations, Dispersion, *Accidental spills, *Time of travel.

This report summarizes the traveltime and dispersion of solutes in 18 streams in Louisiana that were measured by injecting a fluorescent water tracer. Nine of the streams were studied through a range of discharges. The relations of unit concentration and traveltime to discharge in these streams are presented graphically to enable prediction of the traveltimes for contaminants downstream from accidental spills. In addition, standard multiple-linear regression techniques, relating traveltime and dispersion characteristics to basin parameters, were used to develop equations for estimating traveltimes, dispersion of solutes, and peak concentrations for ungaged streams in Louisiana. Examples of use and application of the data and the predictive equations are given. (Woodard-USGS)
W79-04401

GROUND WATER OF THE FORT UNION COAL REGION, EASTERN MONTANA.
Geological Survey, Helena, MT. Water Resources Div.
Montana Bureau of Mines and Geology Special Publications 80, 1978. 47 p.

Descriptors: *Water quality, *Groundwater, *Coal mine wastes, *Strip mines, *Montana, Shallow water, Hydrogeology, Aquifers, Seismic studies, Groundwater movement, Groundwater recharge, Water level fluctuations, Water wells, *Fort Union Coal Region, Saline seeps.

The hydrologic findings of numerous studies recently completed or currently underway by the Montana Bureau of Mines and Geology and the U.S. Geological Survey are described. Pertinent facts are given on the occurrence, movement, and quality of ground water in the Fort Union Coal Region of Montana. The present development, effects of seismic shotholes on ground-water systems, and effects of strip mining of coal on shallow ground-water systems are described also. The primary purpose of the report is to provide basic factual material on ground-water conditions to assist nontechnical readers in understanding the complex ground-water problems existing in eastern Montana. (Woodard-USGS)
W79-04405

IDAHO'S ENVIRONMENT (PROBLEM OF UNFETTERED EXPLOITATION RIGHTS V. ENVIRONMENTAL CONCERN),
For primary bibliographic entry see Field 5D.
W79-04421

LIABILITY FOR OIL POLLUTION UNDER THE MERCHANT SHIPPING (OIL POLLUTION) ACT 1971,
Aberdeen Univ. (Scotland).
For primary bibliographic entry see Field 6E.
W79-04425

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

NONPOINT SOURCE POLLUTION,
For primary bibliographic entry see Field 5A.
W79-04443

THE USE OF CIVIL PENALTIES IN ENFORCING THE CLEAN WATER ACT AMENDMENTS OF 1977,
For primary bibliographic entry see Field 6E.
W79-04449

POPE V. CITY OF ATLANTA (ACT REGULATING CONSTRUCTION IN RIVER FLOOD PLAIN HELD NOT TO BE UNCONSTITUTIONAL TAKING OF PROPERTY WITHOUT COMPENSATION).
For primary bibliographic entry see Field 6E.
W79-04452

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
For primary bibliographic entry see Field 6E.
W79-04457

NON-POINT SOURCE POLLUTION STUDIES IN THE CHINCOTEAGUE BAY SYSTEM,
Virginia Inst. of Marine Science, Gloucester Point, VA. Dept. of Physical Oceanography and Hydraulics.
C. F. Cerco, C. S. Fang, and A Rosenbaum.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 338, Price codes: A09 in paper copy, A01 in microfiche. Special Scientific Report No. 86 April 1978, 174 p, 37 ref. Intensive Hydrographical and Water Quality Survey of the Chincoteague Sinepuxent/ Assawoman Bay Systems, 25 tab, 9 ref.

Descriptors: *Storm runoff, *Mathematical models, *Maryland, Water pollution, Estuarine environment, Virginia.

Based on field data collected from ten sample sites encompassing seven land uses, the U.S. Army Corps of Engineer's STORM model has been calibrated and applied to the watershed of the Chincoteague Bay System located on the eastern shores of Delaware, Maryland, and Virginia. Current and

projected year 2000 non-point source pollution loads have been calculated and current loads have been compared with point source discharges and storm-generated marsh nutrient exports. Point sources are responsible for larger quantities of ammonia and phosphorus while non-point sources contribute greater amounts of nitrate and coliforms. Rough equivalence is noted in the contributions of organic nitrogen and BOD5. A single storm on the local marshes, however, can produce nutrient export of the same order of magnitude as the monthly average point or non-point source loads from the remainder of the basin.
W79-04488

RETENTION AND LEACHING OF NUTRIENTS IN A LIMED ULTISOL UNDER CROPPING,
International Inst. of Tropical Agriculture Ibadan (Nigeria).
A. S. R. Juo, and J. C. Ballaux.
Soil Science Society of America Journal, Vol. 41, No. 4, p 757-761, July-August, 1977. 3 fig, 6 tab, 15 ref.

Descriptors: Maize, *Leaching, Nutrients, Greenhouses, Soils, Soil investigations, Crop response, Crop production, *Lime.

The response of maize to liming and the retention and leaching of Ca and other nutrient ions were studied in the greenhouse using an acid Ultisol from southern Nigeria. The soil was limed to various pH levels and maize was grown for 10 weeks. The largest growth response occurred when the soil pH as raised from 4.3 to 5.0 by liming (1.3 metric ton/ha). The highest yield was obtained when the soil pH was between 5.5 to 6.0. Substantial downward movement of Ca from the limed surface layer was noted, but these Ca ions were mostly adsorbed in the unlimed subsurface layer. Leaching losses of applied nutrient ions (Ca, Mg, K, NO3) were relatively small. There was a significant increase in nitrate content in leachates when soil was limed above pH 7.0. (Skogerboe-Colorado State)
W79-04500

5C. Effects Of Pollution

EARTHWORM POPULATIONS, SOIL BULK DENSITY, POROSITY, AND WATER STABLE AGGREGATES UNDER EFFLUENT APPLICATION,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
L. T. Newell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 846, Price codes: A08 in paper copy, A01 in microfiche. Ms Thesis, July 1977. 142 p, 17 fig, 15 tab, 88 ref, 3 append. OWRT B-048-NY (2).

Descriptors: *Soil properties, *Biomass, *Sewage effluents, *Earthworms, Municipal wastes, Soil amendments, Soil texture, Soil analysis, Soil aggregates, Soil formation, Soil density, Soil tests, Porosity, Soil treatment, Municipal wastes.

Eleven species of earthworms were collected from six sample plots in a study conducted to examine earthworm populations and soil properties, and to comparing plots treated with municipal sewage effluent and untreated (control) plots. The three study areas consisted of a plot treated with a fixed amount of sewage effluent added to the soil and an adjacent untreated plot having the same soil type and vegetative cover. It was determined that soil treated with municipal sewage effluent resulted in an increase in earthworm numbers and biomass. This treatment fostered the growth of Dendrobaena species on the Mixed Hardwood Oak (MHO) plot and of the Lumbricus species on the Reed Canary Grass (RCG) an Old Field (OF) plots. Significant seasonal differences in bulk density and porosity were consistent on the treated RCG plots. On the MHO the treatment resulted in an increase in the smaller water stable aggregates, while the larger water stable aggregates increased on the treated RCG and OF plots. It is concluded that the overall effects of municipal sewage treatment are beneficial to earthworm populations. (Davison-IPA)
W79-04005

DISTRIBUTION OF AUTOTROPHIC NITRIFYING BACTERIA IN A POLLUTED RIVER (THE PASSAIC),
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W79-04070

EFFECTS OF NON-POINT POLLUTION ON BENTHIC INVERTEBRATES IN THE LYNNHAVEN RIVER SYSTEM,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
D. M. Dauer, W. W. Robinson, C. P. Seymour, and A. T. Legett, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 910, Price codes: A06 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University Bulletin 117, February 1979. 112 p, 37 fig, 12 tab, 44 ref, 2 append. OWRT A-075-VA(1).

Descriptors: Estuaries, *Non-point sources, Urbanization, *Benthic fauna, Oysters, Lynnhaven River, Virginia, Nutrient enrichment.

Increased urbanization and non-point sources of pollution in the area of Virginia's Lynnhaven River complex have increased the nutrient content of the adjacent waters, with possible enrichment effects. This research assessed the biological effects of these non-point discharges on estuarine macroinvertebrates in the Western and Eastern branches of the river. First, individual oysters in the Lynnhaven were monitored for growth to determine whether nutrient enrichment enhanced or impeded growth in areas of different water quality. In addition, 10 permanent sites located in the river's intertidal zone from the inlet at the mouth to the headwaters of both branches were used to sample benthic infaunal macroinvertebrate communities. Such biological parameters as species numbers, community density, and community biomass were studied at each site by collecting bimonthly samples (August 1976-June 1977). For comparison, benthic invertebrate samples were collected from Old Plantation Creek in Virginia's Eastern Shore. These data indicate that no significant deterioration of water quality has occurred in the study areas of the Lynnhaven. Results show that macroinvertebrate communities of the Lynnhaven are dominated by a group of animals that are naturally adapted to withstand environmental stress. Comparing the spatial and temporal distribution patterns for each individual species in the Lynnhaven with samples collected in Old Plantation Creek, indicates that the amount of stress placed upon the Lynnhaven's environment by non-point pollution probably has little or no influence upon the natural benthic invertebrate populations.
W79-04071

TRANSIENT TEMPERATURE EFFECTS ON BOD AND DO CONCENTRATIONS ALONG A STREAM,
Kansas State Univ., Manhatten. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5G.
W79-04087

INFLUENCE OF DOMESTIC WASTES ON ENERGETIC PATHWAYS IN ROCKY INTERTIDAL COMMUNITIES,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
M. M. Littler, and S. N. Murray.
Journal of Applied Ecology, Vol. 15,p 583-595, 1978. 2 fig, 3 tab. (California Water Resources Center Project UCAL-WRC-W-49). OWRT A-054-CAL(5).

Descriptors: *Algae, *Intertidal areas, *Biological communities, *Sewage effluents, *Domestic wastes.

The calorific contents of eighteen macroinvertebrates and thrity-six macrophytes were determined in an unpolluted rocky intertidal habitat and in a nearby polluted habitat. Much of the variation in the calorific values of macrophytes was related to life span. The algae that characterized the unpolluted community usually contained comparatively fewer calories per unit weight. These forms had relatively more structural tissues and hence allocated relatively less energy to rapid growth and reproduction. In the polluted habitat, fugitive or opportunistic algal species were more prevalent; these had more rapid growth rates and higher productivities and tended to have relatively high calorific contents. Encrusting forms, that are easily accessible to many herbivores, had thallus constituents with lower calorific vaues, suggesting that these algae may have evolved reduced palatability. The major taxonomic groups of algae yielded the following sequence of mean calorific values: Chlorophyta, 4.78 kcal g(-1) ash-free weight; Rhodophyta, 4.39; Cyanophyta, 4.38; Phaeophyta, 4.22. In nearly every case, macroinvertebrate populations exposed to domestic sewage had higher energy contents than did corresponding populations from the unpolluted habitat. Macroinvertebrates in polluted habitat grazed greater proportions of blue-green algae and bacteria. Omnivores and suspension feeders in the polluted habitat appeared to utilize energy-rich compounds in the sewage effluent; this may explain the greater standing stocks of omnivores in the peripheral regions of outfall plume. (Snyder-California-Davis)
W79-04133

INVESTIGATION OF THE LONG-TERM EFFECTS OF CHLORINE ON THE OXYGEN DEMAND OF WASTEWATERS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W79-04160

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING, PART II: THE AQUATIC MACROINVERTEBRATES OF TROUT CREEK, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
S. P. Canton, and J. V. Ward.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-289 883, Price codes A04 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-095, October 1978. 71 p, 8 fig, 23 tab, 45 ref, 3 append. R803950.

Descriptors: *Invertebrates, *Coal mines, *Trout Creek(Colorado), :Mine acids, *Environmental effect, Biology, Aquatic insects, Aquatic environment, Caddisflies, Water pollution, Water pollution sources, Biomass, Benthos, Standing crops, Aquatic life, Biota, Strip mines, Strip mine wastes, Mine drainage.

A study conducted over a 21 month period on Trout Creek in Colorado assessing the effects of coal mine drainage on stream macroinvertebrates is reported. Throughout the study area density and biomass showed a general increase, in the downstream direction with significant seasonal variations. Over 90% of the fauna were aquatic insects, most of which were caddisflies. During the study period there were no definite indications of stressed conditions in the macroinvertebrate community. The invertebrates appeared able to withstand the period of water quality degradation resulting from the spring runoff. It is thought that the buffer zone existing between the mine and the creek decreases the effects of mine drainage, and therefore it should remain to insure the stability of the macroinvertebrate community. (Davison-IPA)
W79-04252

SIMAZINE RESIDUES IN CANAL WATER AND CROPS RESULTING FROM EXPERI-

MENTAL APPLICATION FOR DITCHBANK WEED CONTROL,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 5B.
W79-04267

BEHAVIOR AND TRANSPORT OF MERCURY IN RIVER-RESERVOIR SYSTEM DOWNSTREAM OF INACTIVE CHLORALKALI PLANT,
Oak Ridge National Lab., TN. Environmental Sciences Div.
R. R. Turner, and S. E. Lindberg.
Environmental Science and Technology, Vol. 12, No. 8, p 918-923, August, 1978.

Descriptors: *Mercury, *Water pollution, *Virginia, Wastes, Industrial wastes, Water pollution sources, Metals, Chemical wastes, Suspended load, Bottom sediments, Sediments, Toxicity, Silts, Clays, Waste dilution, Chlor-alkali plant, Holston River(Virginia), Reservoirs, Rivers, Surface waters.

Aquatic losses of mercury from a former chlor-alkali plant (closed in 1972) located on the north fork of the Holston River, Virginia, continues to cause elevated levels of mercury in downstream water, suspended matter, and bottom sediment. These losses are attributed to leaching of soluble mercury in solid wastes located at the site and have recently amounted to about 39 kg/yr. Concentrations of mercury in water and suspended matter immediately downstream of the plant site are typically 20 times higher than immediately upstream. The silt-clay fraction of bottom sediment immediately downstream of the plant site contains up to 200 times as much mercury as similar sediments collected immediately upstream. Field observations and application of a simple dilution model indicate that rapid decreases in mercury concentrations in water as a function of distance below the plant site could be accounted for partially by dilution, although up to 60% of the observed decreases are apparently related to nondilution processes. (Louden-IPC)
W79-04290

HISTOPATHOLOGICAL AND PHYSIOLOGICAL RESPONSES OF FUNDULUS HETEROCLITUS TO NAPTHALENE EXPOSURE,
Delaware Univ., Newark. School of Life and Health Sciences.
L. DiMichele, and M. H. Taylor.
Journal of the Fisheries Research Board of Canada, Vol. 35, No. 8, p 1060-1066, 1978. 3 fig, 3 tab, 22 ref. OWRT A-043-DEL(1). 14-34-0001-8008.

Descriptors: Toxicity, *Naphthalene, Teleosts, Histopathology, Fundulus, Mummichog, *Fish diseases.

Mummichogs, Fundulus heteroclitus, were exposed to napthalene concentrations ranging from 30 to 0.002 mg/L over time periods ranging from 1 to 15 d. Histopathology of exposed animals was evaluated. Major effects were found in the brain, liver, and pancreas down to 0.2 mg/L for a 15-d exposure. The results of these experiments indicate that the toxicity of napthalene in this fish is due primarily to its effect on blood components. There was also evidence of neurosensory damage at exposures as low as 0.02 mg/L for 15 d. In addition, serum glucose, protein, and cortisol were measured in animals exposed to low levels of napthalene for 15 d. All were significantly elevated, indicating metabolic stress at exposures as low as 0.02 mg/L. C-napthalene uptake was measured at two concentrations of napthalene. Napthalene was found to accumulate in significant amounts in organs most susceptible to pathology. The distribution of naphthalene was found to be independent of its water concentration in all organs tested except the spleen.
W79-04312

SALINITY EFFECTS ON GROWTH AND TOXIN CONTENT OF GONYAULAX EXCAVATA, A MARINE DINOFLAGELLATE CAUSING PARALYTIC SHELLFISH POISONING,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
For primary bibliographic entry see Field 5B.
W79-04313

TOXICITY OF CUPRIC ION TO EGGS OF THE SPOT LEIOSTOMUS XANTHURUS AND THE ATLANTIC SILVERSIDE MENIDIA MENIDIA,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
D. W. Engel, and W. G. Sunda.
Marine Biology, Vol. 50, p 121-126, 1979. 1 fig, 3 tab, 10 ref.

Descriptors: *Copper, *Toxicity, *Fish eggs, Fish reproduction, Fish physiology, Growth stages, Ions, Metals, Chemical reactions, Chemical analysis, Copper sulfate, Inhibition, Chelation, Mortality, Trophic level, *Leiostomus, *Menidia, *Buffers, Marine fish.

Experiments were conducted to determine the toxicity of free cupric ion to the eggs of two marine fish: the spot and the Atlantic silverside. A cupric ion buffer consisting of 5 mM of the chelator, trishydroxy-methylamino methane (Tris), and varied concentrations of CuSO4 was employed to achieve stable cupric ion activities in experimental seawater media. Egg hatch of the silverside appears to be more sensitive to cupric ion than that of the spot. The silverside had 60% inhibition of hatch at a pCu (negative logarithm of cupric ion activity) of 9.4 with complete suppression of hatching at pCu values below 8.2, while the spot had 50% inhibition at a pCu of 9.0 and complete suppression at a pCu of 8.0. Cupric ion was most toxic to the eggs of silverside at or around the time of hatching, whereas a pronounced sensitivity at hatching was not apparent with the eggs of spot. Calculated estimates of the range of cupric ion activity in seawater indicate that natural activity levels may in some instances inhibit the hatching of silverside and spot eggs. (Deal-EIS)
W79-04314

THE EFFECT OF PETROCHEMICAL STRUCTURE ON METHANE FERMENTATION TOXICITY,
Drexel Univ., PA. Environmental Studies Inst.
For primary bibliographic entry see Field 5A.
W79-04315

FIRTH OF FORTH OIL POLLUTION INCIDENT, FEBRUARY 1978,
Royal Society for the Protection of Birds Sandy (England).
For primary bibliographic entry see Field 5B.
W79-04316

EFFECTS OF NO. 2 FUEL OIL ON HATCHABILITY OF MARINE AND ESTUARINE BIRD EGGS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
D. H. White, K. A. King, and N. C. Coon.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 7-10, 1979. 2 tab, 5 ref.

Descriptors: *Mortality, *Oil, *Water birds, *Bird eggs, Embryonic growth stage, Gulls, Oil spills, Oil pollution, Fuels, Organic compounds, Toxicity, Hatching, Reproduction, Nests, Fertility, *Herons, *Terns.

Eggs of Louisiana herons, sandwich terns, and laughing gulls were oiled with either 0, 5, or 20 microliters of No 2 fuel oil in the field and in the laboratory. After 5 days of natural incubation, field-oiled and control eggs were opened and embryonic mortality was determined. No 2 fuel oil produced 61% mortality in Louisiana heron eggs, 56% in sandwich tern eggs, and 83% in laughing gull eggs. Hatching success of artificially incubated, oiled eggs appeared to be lower than in control eggs. However, stress during shipment to the laboratory and problems within the incubator probably contributed to reduced hatchability in both groups. (Deal-EIS)
W79-04317

EFFECTS OF TRICHLOROETHYLENE, HEXACHLOROBENZENE AND POLYCHLORINATED BIPHENYLS ON THE GROWTH AND CELL SIZE OF MARINE PHYTOPLANKTON,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
D. C. Biggs, R. G. Rowland, and C. F. Wurster.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 196-201, 1979. 1 fig, 1 tab, 18 ref.

Descriptors: *Phytoplankton, *Algae, *Chlorinated hydrocarbon pesticides, *Pesticide toxicity, Pesticides, Toxicity, Aroclors, Polychlorinated biphenyls, Diatoms, Growth rates, Cytological studies, Chlorophyta, *TCE, *HCB, Trichloroethylene, Hexachlorobenzene.

The effects of TCE and HCB on marine phytoplankton are reported. Mixed laboratory cultures of an estuarine centric diatom, Thalassiosira pseudonana and a green alga, Dunaliella tertiolecta were used. Neither TCE nor HCB inhibited algal growth at 50 or 100 micrograms/L. While cultures were growing exponentially, cell size distribution did not differ significantly from controls. Even when TCE or HCB were added daily at concentrations of 50 or 100 micrograms/L, the cell size distribution did not differ significantly from controls. It was concluded that the much lower naturally-occurring levels of these pesticides would have no effect on algal growth or alter species succession within natural phytoplankton assemblages. (Deal-EIS)
W79-04318

THE INFLUENCE OF SALINITY ON TOXICITY OF CADMIUM AND CHROMIUM TO THE BLUE CRAB, CALLINECTES SAPIDUS,
Kelly High School Beaumont, TX.
P. M. Frank, and P. B. Robertson.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 74-78, 1979. 2 fig, 1 tab, 16 ref.

Descriptors: *Toxicity, *Cadmium, *Chromium, *Crabs, *Salinity, Mortality, Bioassay, Heavy metals, Industrial wastes, Chemical wastes, Chemical analysis, Salts, Path of pollutants, Animal physiology, Water chemistry, Water analysis, Juvenile growth stage, Commercial shellfish.

This study reports the lethal concentrations of cadmium and chromium to juvenile blue crabs in acute toxicity tests at three different salinities. The 24, 48, 72 and 96-hr LC50 was determined for exposure to cadmium and chromium at salinities of 1, 15, and 35 ppt. As expected, cadmium was much more toxic than chromium at all salinities. Toxicity of both metals decreased with increasing salinity. The limitations of acute toxicity tests were also discussed. (Deal-EIS)
W79-04319

EFFECT OF PCBS AND OTHER ORGANOCHLORINE COMPOUNDS ON THE HATCHABILITY OF ATLANTIC SALMON (SALMO SALAR) EGGS,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
V. Zitko, and R. L. Saunders.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 125-130, 1979. 2 fig, 2 tab, 7 ref.

Descriptors: *Pesticide residues, *Fish eggs, *Atlantic salmon, Polychlorinated biphenyls, Chlorinated hydrocarbon pesticides, *DDT, *DDD, DDE, Pesticide toxicity, Chemical analysis, Fertility, Mortality, Fish physiology, Path of pollutants, *Chlordane, *Hexachlorobenzene, *Tissue analysis, *Bioaccumulation.

This paper reports changes in recent years in the levels of PCB's, hexachlorobenzene, and several organochlorine pesticides in Atlantic salmon eggs and the associated effects on hatchability and survival. The levels of PCB's and DDE were lower in 1975 and 1976 than those reported for 1971 while the levels of DDT and DDD remained practically constant. Recent samples also contained increased levels of hexachlorobenzene and for the first time, detectable levels of chlordane. No apparent correlations between levels of organochlorine compounds and hatchabilities were noted in the four salmon stocks studied. (Deal-EIS)
W79-04320

THE ACCUMULATION AND ELIMINATION OF DIFLUBENZURON BY FISH,
California Univ., Fresno. Mosquito Control Research Lab.
C. H. Schaefer, E. F. Dupras, Jr, R. J. Stewart, L. W. Davidson, and A. E. Colwell.
Bulleting of Environmental Contamination and Toxicology, Vol. 21, p 249-254, 1979. 3 tab, 10 ref.

Descriptors: *Insecticides, *Pesticide kinetics, *Sunfishes, Path of pollutants, Pesticide residues, Chlorinated hydrocarbon pesticides, Fish physiology, Animal metabolism, Chromatography, Chemical analysis, Chemical properties, Enzymes, Proteins, Biochemistry, DDT, Biodegradation, *Diflubenzuron, *Tissue analysis, *Bioaccumulation.

Diflubenzuron is accumulated from water into fish tissues at levels up to 80 fold within 24 hr when fish are exposed to concentrations of 10 ppb. Within the concentration range of 1-10 ppb, the amount accumulated in a 24 hr exposure is proportional to concentration. After 24 to 48 hr exposure fish degrade and eliminate diflubenzuron. The excretory products are neither the parent compound nor p-chloro-phenylurea. The amount of diflubenzuron remaining in fish tissues with time is dependent on the reduction of residue concentration in water; however, the potential for degradation and eliminations is very great. (Deal-EIS)
W79-04321

BIOMAGNIFICATION OF HEAVY METALS BY ORGANISMS IN A MARINE MICROCOSM,
Texas Univ. Health Science Center at Houston. School of Public Health.
For primary bibliographic entry see Field 5B.
W79-04322

ACUTE TOXICITY OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL TO THE MANILA CLAM,
California Univ., Bodega Bay. Bodega Marine Lab.
P. Nunes, and P. E. Benville, Jr.
Marine Pollution Bulletin, Vol. 9, p 324-331, 1978. 4 fig, 5 tab, 4 ref.

Descriptors: *Toxicity, *Oil, *Clams, Methodology, Bioassay, Oil spills, Oil pollution, Organic compounds, Solubility, Mortality, Animal behavior, Animal physiology, Animal metabolism, Bioassay, Analytical techniques, Laboratory equipment, *Crude oil, Manila clam.

Recognition of the inherent complexities of oil bioassays prompted the development of several apparatuses designed to deliver uniform solutions of the water-soluble components of crude oil and capable of system equilibration for both static and continuous-flow bioassays without the loss of the more volatile compounds and without the formation of emulsions. Clams from a relatively contaminated area exhibited greater resistance to the water-soluble fraction of Cook Inlet crude oil than specimens from a more pristine area. Behaviour was altered below lethal levels suggesting the possibility of using behavioural modifications as a concommitant criterion of toxicity with mortality. An increase in mortality with a longer exposure period and a significant rate of latent mortalities following the end of the 96-h exposure period suggest that future bioassays with bivalves should be determined over a longer exposure period. (Deal-EIS)
W79-04323

THE PETROLEUM-INDUCIBLE MIXED-FUNCTION OXIDASE OF CUNNER (TAUTOGOLABRUS ADSPERSUS WALBAUM 1792): SOME CHARACTERISTICS RELEVANT TO HYDROCARBON MONITORING,
Memorial Univ. of Newfoundland, St. John's. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-04324

SWIMMING SPEEDS OF OYSTER LARVAE CRASSOSTREA VIRGINICA IN DIFFERENT SALINITIES AND TEMPERATURES,
New Jersey Oyster Research Lab., New Brunswick.
For primary bibliographic entry see Field 5A.
W79-04325

INCREASE IN THE HUMAN BLOOD PCB LEVELS PROMPTLY FOLLOWING INGESTION OF FISH CONTAINING PCBS,
Osaka Prefecture Inst. of Public Health (Japan). Lab. of Food Chemistry.
For primary bibliographic entry see Field 5B.
W79-04326

SPECTROPHOTOMETRICALY ASSAYED INHIBITORY EFFECTS OF MERCURIC COMPOUNDS ON ANABAENA FLOS-AQUAE AND ANACYSTIS NIDULANS (CYANOPHYCEAE),
New Orleans Univ., LA. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-04327

ELUTRIATE-PRIMARY PRODUCTIVITY BIOASSAYS OF DREDGE SPOIL DISPOSAL IN LAKE ERIE,
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
For primary bibliographic entry see Field 5B.
W79-04329

OCCURRENCE OF TOXIC BIVALVES IN ASSOCIATION WITH GONYAULAX PLANKTONS IN ISE, OWASE, AND OFUNATO BAYS,
Tokyo Univ. (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 5B.
W79-04331

EFFICIENCY OF CANAL BIODEGRADATION OF PALM OIL SLUDGE AND ITS POLLUTION EFFECTS,
Universiti Sains Malaysia, Penang. Pusat Pengajian Sains Kajihayat.
For primary bibliographic entry see Field 5D.
W79-04332

IN VIVO EFFECT OF ENDRIN ON THREE PHOSPHATASES IN KIDNEY AND LIVER OF THE FISH OPHIOCEPHALUS PUNCTATUS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and S. K. Sharma.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 185-189, 1979. 1 tab, 18 ref.

Descriptors: *Enzymes, *Endrin, *Pesticide toxicity, Chlorinated hydrocarbon pesticides, Pesticide residues, Pesticide kinetics, Chemical properties, Chemical analysis, Fish physiology, Animal metabolism, Biochemistry, Proteins, *Ophiocephalus, *Tissue analysis.

The effect of endrin (0.030 ppm) on the acid phosphatase, alkaline phosphatase and glucose-6-phosphatase activities in the kidney and liver of a teleost fish, Ophiocephalus (Channa) punctatus has been studied. The period of exposure was twenty days. An increase in the acid phosphatase activity was noted in the two tissues examined. There was no significant change in the activity of alkaline phosphatase in kidney while in liver the enzyme was inhibited. In the kidney glucose-6-phosphatase showed a slight increase in activity but it was inhibited in liver. (Deal-EIS)
W79-04333

BEHAVIOR OF MERCURY IN BIOSYSTEMS. III. BIOTRANSFERENCE OF MERCURY THROUGH FOOD CHAINS,
Georgia Univ., Athens. Dept. of Food Science.
For primary bibliographic entry see Field 5B.
W79-04334

METHYLATED MERCURY IN BROOK TROUT (SALVELINUS FONTINALIS): ABSENCE OF AN IN VIVO METHYLATING PROCESS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W79-04335

GROWTH OF FISHES DURING OLIGO-, MESO, AND EUTROPHIC STATUS OF LAKE CONSTANCE (FISCHWACHSTUM BEI OLIGO-, MESO- UND EUTROPHIE DES BODENSEES),
Staatliches Inst. fuer Seenforschung und Fischereiwesen, Langenargen (Germany, F.R.).
V. J. Hartmann.
Schweizerische Zeitschrift fur Hydrologie, Vol. 40, No. 1, p 32-39, 1978. 3 fig, 2 tab, 21 ref. (In German with English Abstract).

Descriptors: *Freshwater fish, Lakes, *Lake Constance, *Eutrophication, Oligotrophy, Mesotrophy, Fish diets, *Fish growth, Fish food organisms, Fish populations, Growth rates, Whitefish, Switzerland.

Recent growth of 14 fish taxa of Lake Constance has been studied. In the mesotrophic basin summer-pelagic species opposite to the others appears to grow faster now than during earlier oligotrophic status. From trends of growth, feeding and yield (table) it is concluded that eutrophication has favoured planktivores. In the eutrophic lower basin only coregonids grown slower than in the mesotrophic part of the lake. Factors that have caused growth differences are thought to be food density and water temperature (through chaned fish distribution and different shape of basin). (Katz-EIS)
W79-04336

THE RELATIVE CONTRIBUTIONS OF METHYLMERCURY FROM FOOD OR WATER TO RAINBOW TROUT (SALMO GAIRDNERI) IN A CONTROLLED LABORATORY ENVIRONMENT,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5B.
W79-04337

LEVELS OF BLOOD GLUCOSE AND TISSUE GLYCOGEN IN TWO LIVE FISH EXPOSED TO INDUSTRIAL EFFLUENT,
Centra Fisheries Extension Training Center, Hyderbad (India).
For primary bibliographic entry see Field 5A.
W79-04338

TOXICITIES OF CADMIUM, COPPER, AND ZINC TO FOUR JUVENILE STAGES OF CHINOOK SALMON AND STEELHEAD,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
G. A. Chapman.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 841-847, 1978. 5 tab, 19 ref.

Descriptors: *Toxicity, *Cadmium, *Copper, *Zinc, Rainbow trout, Chinook salmon, Bioassay,

Growth stages, Juvenile growth stage, Fry, Smolt, Resistance, Heavy metals, Water chemistry, Salmonids, Fish physiology, Spectrophotometry, *Parr, *Tissue analysis, *Bioaccumulation.

Continuous-flow toxicity tests were conducted to determine the relative tolerances of newly hatched alevins, swim-up alevins, parr, and smolts of chinook salmon (Oncorhynchus tshawytscha) and steelhead (Salmo gairdneri) to cadmium, copper, and zinc. Newly hatched alevins were much more tolerant to cadmium and, to a lesser extent, to zinc than were later juvenile forms. However, the later progression from swim-up alevin, through parr, to smolt was accompanied by a slight increase in metal tolerance. The 96-h LC50 values for all four life stages ranged from 1.0 to > 27 micrograms Cd/liter, 17 to 38 micrograms Cu/liter and 93 to 815 micrograms Zn/liter. Steelhead were consistently more sensitive to these metals than were chinook salmon. When a sensitive life stage for acute toxicity tests with metals is sought, the more resistant newly hatched alevins should be avoided. Although tolerance may increase with age, all later juvenile life stages are more sensitive and should give similar results. (Deal-EIS)
W79-04339

ACUTELY LETHAL LEVELS OF CADMIUM, COPPER, AND ZINC TO ADULT MALE COHO SALMON AND STEELHEAD,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
G. A. Chapman, and D. G. Stevens.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 837-840, 1978. 1 tab, 12 ref.

Descriptors: *Mortality, *Copper, *Cadmium, *Zinc, Lethal limit, Rainbow trout, Sockeye salmon, Toxicity, Heavy metals, Fish physiology, Hardness(Water), Alkalinity, Water chemistry, Growth stages, Chemical analysis, Fish reproduction, Spawning, Water pollution effects.

Flow-through acute toxicity tests of cadmium, copper, and zinc were conducted with adult male coho salmon (Oncorhynchus kisutch) and adult male steelhead (Salmo gairdneri). The 96-h LC50 values for copper were 46 and 57 micro g/liter, and for zinc were 905 and 1,755 micro g/liter, for coho salmon and steelhead, respectively. Mortality induced by cadmium was slow in onset, but 50% mortality occurred after more than a week at 3.7 micro g/liter for coho salmon and 5.2 micro g/liter for steelhead. Hardness and alkalinity of the water supply were higher during the toxicity tests with steelhead, complicating direct comparisons between the two species. (Deal-EIS)
W79-04340

TOXICITY OF TEXTILE WASTE TO SOME TELEOST FISHES,
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, A. K. Tyagi, and R. C. Dalela.
Water, Air and Soil pollution, Vol. 10, No. 3, p 351-358, 1978. 4 tab, 15 ref.

Descriptors: *Toxicity, *Industrial wastes, *Bleaching wastes, Chemical wastes, Bioassay, Textiles, Waste water, Mortality, Freshwater fish, Fish behavior, Fish physiology, Animal metabolism, Alkalis(Bases), Water quality standards, Fish diseases, Animal pathology, Suspended solids, Hydrogen ion concentration, *Tissue analysis, Textile wastes.

LC50 values for different periods, acute toxicity ranges and presumable harmless concentrations, along with relative susceptibility of a few freshwater teleost fish to textile waste have been determined. The presumable harmless concentration to regulate the disposal of this waste was 1.1254, 0.4966, 0.9912, 1.0157, and 1.086% by volume for fish, Saccobranchus fossils, Labeo rohita, Notopterus notopterus, Colisa fasiatus, and Ophiocephalus punctatus, respectively. (Deal-EIS)
W79-04341

THE ACUTE TOXICITY OF COPPER TO GAMMARUS FASCIATUS SAY, A FRESHWATE AMPHIPOD,
Colorado State Univ., Ft. Collins.
R. D. Judy, Jr.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 219-221, 1979. 3 fig, 1 tab, 6 ref.

Descriptors: *Copper, *Toxicity, *Amphipoda, Bioassay, Rainbow trout, Food webs, Fish food organisms, Metals, Copper sulfate, Mortality, Laboratory tests, Water chemistry, Laboratory tests, Laboratory animals, *Gammarus.

The results of a 48 hr acute bioassay for copper were significant. The response of G. fasciatus to copper was reproducible. The results of the tests are also significant when compared with published values for rainbow trout. It is suggested that these organisms could be used as the experimental organisms of importance in areas where they are found in abundance. (Deal-EIS)
W79-04342

THE EFFECT OF TEMPERATURE ON COPPER TOLERANCE OF PARAMECIUM,
Illinois Univ. at the Medical Center, Chicago. Dept. of Biological Sciences.
C. Szeto, and D. Nyberg.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 131-135, 1979. 2 tab, 9 ref.

Descriptors: *Copper, *Toxicity, *Protozoa, *Water temperature, Seasonal, Heavy metals, Animal physiology, Resistance, Mortality, Copper sulfate, Chemical properties, Chemical analysis, Water chemistry, *Paramecium.

The copper tolerance of Paramecium tetrayrelia linearly decreases with increasing temperatures over the range of 12C to 34C. These results indicate that copper toxicity to at least some organisms can be considerably modified by other environmental parameters. For example, the same concentration of copper that produced no mortality in winter could be toxic in the summer. (Deal-EIS)
W79-04343

ARSENIC ACCUMULATION, TISSUE DISTRIBUTION AND CYTO-TOXICITY IN TELEOSTS FOLLOWING INDIRECT AQUEOUS EXPOSURES,
Texas Univ. at Austin. Dept. of Zoology.
E. M. B. Sorensen, R. E. Henry, and R. Ramirez-Mitchell.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 162-169, 1979. 2 fig, 1 tab, 15 ref.

Descriptors: *Toxicity, *Fish physiology, *Arsenic compounds, *Sunfishes, Microscopy, Cytological studies, Chemical analysis, Path of pollutants, Teleosts, Bioassay, Neutron activation analysis, Animal metabolism, *Arsenic, *Tissue analysis, *Bioaccumulation.

Fish were exposed to arsenic under controlled experimental conditions and sacrificed at specific intervals for measurement of progressive arsenic concentration within various critical organs. The gall bladder and bile accumulated the highest concentrations of arsenic during the 6-day exposure interval. Levels increased from about 35 to 78 to 159 ppm during the 2, 4, and 6-day exposures, respectively. Liver, spleen and kidney also accumulated significant amounts of arsenic. Cellular alterations as observed under light microscopy are described. (Deal-EIS)
W79-04344

ALTERATION IN THE ACTIVITIES OF THREE PEPTIDASES AND LIPASE IN THE DIGESTIVE SYSTEM OF THE FISH CHANNA PUNCTATUS EXPOSED TO LEAD NITRATE,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and P. K. Gupta.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 190-195, 1979. 2 tab, 16 ref.

Descriptors: *Lead, *Toxicity, *Enzymes, Nitrates, Heavy metals, Biochemistry, Proteins, Chemical reactions, Chemical analysis, Animal metabolism, Fish physiology, Bioassay, *Channa, *Tissue analysis.

The effect of exposure of Channa punctatus to LC(50) (6.8 mg/L) and sublethal concentration (2.8 mg/L) of lead nitrate on the activities of amino tripeptidase, glycyglycine, leucyl-l-glycine dipeptidases and lipase has been investigated. An inhibition in the activities of al the enzymes was noted after 96 hr, 15 and 30 days of treatment period. The inhibition in lipase activity was statistically insignificant in both the acute and chronic treatment cases. The experiments indicated that lead induced toxicity was more severe in chronic treatment as compared to acute treatment. (Deal-EIS)
W79-04345

CORPORATE COMPLIANCE AND COMPENSATION PROBLEMS IN ENVIRONMENTAL PROTECTION: IMPLICATIONS OF UNITED STATES V. RESERVE MINING COMPANY,
For primary bibliographic entry see Field 5G.
W79-04431

FLOATING NUCLEAR PLANTS - A 'REASONABLE USE' OF THE HIGH SEAS,
For primary bibliographic entry see Field 6E.
W79-04436

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
For primary bibliographic entry see Field 6E.
W79-04457

CARBONATE HYDROGEOLOGIC ENVIRONMENTS: THEIR RELATIONSHIP TO LAND USE, WATER RESOURCES DEVELOPMENT AND MANAGEMENT,
The Pennsylvania State Univ., University Park. Dept. of Geoscience.
For primary bibliographic entry see Field 4B.
W79-04494

5D. Waste Treatment Processes

THE EFFECTS OF ALUM SLUDGE ON PRIMARY SEDIMENTATION AND ANAEROBIC DIGESTION,
Auburn University, AL. Dept. of Civil Engineering.
B. A. Rindt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 709, Price codes: A06 in paper copy, A01 in microfiche. Ms Thesis, August 24, 1973. 109 p, 13 fig, 3 tab, 49 ref, 5 append. OWRT A-040-ALA(2).

Descriptors: *Sewage treatment, *Water pollution sources, *Alum sludge, *Anaerobic digestion, *Sedimentation, Sludge disposal, Water treatment, Coagulation, Methane bacteria, Biological treatment, Investigations, Laboratory tests, Anaerobic bacteria, Biochemical oxygen demand, Activated sludge, Sewage systems.

A study investigating the feasibility of disposing alum sludge to sanitary sewers is reported. Since primary clarification and anaerobic digestion are the two sewage treatment processes most likely to be affected by alum sludge disposal, their physical and chemical responses to alum sludge were examined. The experimental investigation involved the

se of a laboratory-created sludge and a sludge ollected from the Auburn, Alabama, water treat- ıent plant to study sedimentation with respect to ettling time and sludge dosage; the effects of alum ludge on the operation of laboratory scale anaero- ic digesters was studied. The investigation result- d in nine specific conclusions concerning the pri- ıary sedimentation process, and seven specific onclusions for anaerobic digestion. It is generally oncluded that disposal of alum sludge to sewers is easible, and sometimes beneficial, if domestic vaste water treatment plants are capable of han- ling increased hydraulic and biological loads, and ıat the alum sludge be discharged to the sewers n a continuous flow basis during peak biological oading. (Davison-IPA)
V79-04001

BASIS FOR AERATION DESIGN,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
S. Hunter, III.
Available from the National Technical Information ervice, Springfield, VA 22161 as PB-290 718, rice codes: A11 in paper copy, A01 in microfiche. Doctoral Dissertation, 1977. 242 p, 32 fig, 17 tab, 14 ref, 10 append. OWRT A-008-COLO (2).

Descriptors: *Waste water treatment, *Activated udge, *Aeration, Mass transfer, Oxygen, Math- matical models, Equations, Investigations, Labo- atory tests, Interfaces, Biological treatment, ludge treatment.

esearch undertaken to initiate steps toward devel- ping a unified aeration design concept by identify- g a measurable parameter or group of parameters ıat could be used to describe oxygen mass transfer ross a gas-liquid interface is reported. An exami- ation of the gas-liquid mass transfer theory and a terature search indicated that temporal mean ve- ocity gradient G might serve as the parameter eing sought. The development of an empirical quation for expressing oxygen mass transfer as a nction of G for any one type of aeration system ould strongly support hypothesis that a general elationship for predicting oxygen mass transfer xists. These studies show that oxygen mass trans- r rate for laboratory-scale submerged turbine aer- ion systems can be expressed as a function of G. Davison-IPA)
V79-04002

IABILITY MEASUREMENTS ON ACTIVAT- D SLUDGE,
labama Univ. in Birmingham. Dept. of Biology.
E. Russell.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB-290 805, rice codes: A05 in paper copy, A01 in microfiche. IS Thesis, 1978. 91 p, 13 fig, 18 tab, 68 ref. WRT A-060-ALAB(2).

Descriptors: *Measurements, *Viability, *Activat- d sludge, Waste treatment, Effluents, Industrial astes, Municipal wastes, Biodegradation, Sludge eatment, Phenol, Laboratory tests, Monitoring.

study to determine cell viability in industrial and unicipal sludges is reported. Viability measure- ents incorporated into routine monitoring of an dustrial activated sludge plant included: (1) fluor- ence microscopy, (2) viable plate counts, (3) ssay of ATP levels, and (4) endrogenous and bstrate stimulated oxygen consumption. The andard monitoring techniques used included LVSS. All measurements were correlated with ffluent water quality. The effluent water quality the municipal plant was measured as Biological xygen Demand, and that at the industrial plant as measured by monitoring concentrations of cer- in chemicals in the waste water. Variations of veral parameters were compared relative to LSS over the entire study period. ATP and uorescence microscopy measurements correlated ith each other, and varied over a broader range ggesting probable variations in the physiological ate of the microbes. Plate count data yielded a uch lower number of viable cells than other ethods and varied over a wider range. Preliminary work done with oxygen consumption in the presence of phenol demonstrated a significant response to this substrate. This type of procedure furnishes a tool for investigating individual types of organisms within a population. This study established a base line for control of chemostat-pilot plant experiments. (Davison-IPA)
W79-04006

BACTERIAL METABOLISM OF ARYLSULFONATES: ROLE OF META CLEAVAGE IN BENZENE SULFONATE OXIDATION BY PSEUDOMONAS TESTOSTERONI,
Maryland Univ., College Park. Dept. of Microbiology.
M. J. Ripin, T. M. Cook, K. F. Noon, and L. E. Stark.
Applied Microbiology, Vol. 29, No. 3, p 382-387, March 1975. 5 fig, 5 tab, 14 ref. OWRT A-009-MD(2).

Descriptors: *Water pollution sources, *Microorganisms, *Bacteria, Industrial wastes, Chemical waste, Laboratory tests, Oxidation, Waste water treatment, Biodegradation, Biological treatment, Chemical reactions, Metabolism.

The oxidation of arylsulfonates by pseudomonas testosteroni is reported. Arylsulfonates are intermediates and byproducts in industrial chemical processes frequently found in industrial waste waters. Pseudomonas testosteroni H-8 oxidized some lower alkylbenzene sulfonates at rates inversely related to the length of the alkyl group. Some arylsulfonates produced 40 to 50% inhibition of oxygen uptake with benzene sulfonate (BS), and almost complete inhibition (97%) was shown with butylbenzene sulfonate. Oxidation of catechol was rapid and without lag for cells grown on BS. Accumulation of yellow meta cleavage products was shown when cells grown in BS were exposed to catechol, ethylbenzene sulfate (EBS) and propylbenzene sulfate (PS). No color developed with BS and TS. It was found that PS inhibited growth and respiration on BS; oxidation of glutamate was unaffected. It is suggested that the formation of the meta cleavage product from PS and the inhibition of catechol oxidation by PS may not be due to the PS, but to a metabolite. (Davison-IPA)
W79-04013

CLADOCERAN SURVIVAL STUDIES IN A KRAFT PULP MILL AERATED STABILIZATION BASIN,
K. K. Chew, and K. E. Norman.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 886, Price codes: A04 in paper copy, A01 in microfiche. State of Washington Water Research Center, Washington State University, Pullman. Completion report, December 16, 1978. 47 p, 12 fig, 2 tab, 44 ref. OWRT-A-093-WASH(2).

Descriptors: *Zooplankton, *Moina macrocopa, *Water pollution control, *Pulp wastes, Laboratory tests, Sampling, Aquatic populations, Biochemical oxygen demand, Water quality, Water analysis, Settling basins, Waste treatment, Water pollution sources, Aerated lagoons, Biological treatment.

The cladoceran stocks in the Weyerhaeuser settling pond in Everett, Washington, were examined over the year regarding the spatial, temporal, and abundance of M. macrocopa. In determining whether physical factors could be correlated with the presence or absence of M. macrocopa, the following water quality parameters were considered; biochemical oxygen demand (BOD), total suspended solids (TSS), pH, temperature, dissolved oxygen (DO), and sunlight/day. Field sampling and laboratory studies were conducted to test the use of M. macrocopa for enhancement of waste treatment, and to investigate the potential for controlling these zooplankton population levels by nutrient manipulation. The potential use of M. macrocopa as a marketable fish food was studied. It was found that the distribution of these animals is seasonal and uneven through the lagoon. Temperature and sunlight did not account for a large part of the population flux. It is thought that nutrient depletions during bloom conditions were responsible for the population flux. M. macrocopa removed TSS by ingestion and had a significant beneficial impact on water quality through aiding waste abatement. Their potential as a fish food was demonstrated in the laboratory. (Davison-IPA).
W79-04111

MODEL STUDIES ON THE EFFECTS OF ALUM SLUDGE ON THE ACTIVATED SLUDGE WASTE TREATMENT PROCESS,
Auburn Univ., AL.
J. R. Voorhees.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 891, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, December 11, 1974. 108 p, 24 fig, 13 tab, 33 ref, 2 append. OWRT-A-040-ALA(4).

Descriptors: *Alum sludge, *Waste water treatment, *Sewage treatment, *Activated sludge, Municipal wastes, Phosphates, Nitrification, Water purification, Laboratory tests, Sewage systems, Chemical oxygen demand, Adsorption, Neutralization.

The impact of releasing alum sludge, generated by water purification processes, to sanitary sewer systems is reported. Phase I of the three phase investigation is concerned with the start-up and routine feeding of the eight reactors used. Phase II included the procedures used when a laboratory-prepared aluminum hydroxide sludge was fed to four of the reactors. Phase II involved the procedures used when alum sludge, collected from the Auburn, Alabama, water treatment plant was added to three of the remaining reactors. Laboratory prepared alum sludge fed to the reactors containing activated sludge showed no adverse effects on COD and TOC removal, and did not affect the nitrification process. The alum sludge greatly improved phosphate removal. Alum sludge, introduced as one shock load to the reactors containing the water treatment plant sludge, resulted in severe, temporary decrease in COD and TOC removal; the system recovered and removals increased. The nitrification process and phosphate removal were not affected. (Davison-IPA)
W79-04114

THE EFFECTS OF ALUM SLUDGE ON ANAEROBIC DIGESTION,
Auburn Univ., AL.
R. C. Reed.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 890, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, March 18, 1975. 82 p, 7 fig, 16 tab, 30 ref, 2 append. OWRT-A-040-ALA(3).

Descriptors: *Sewage treatment, *Water pollution sources, *Alum sludge, Anaerobic digestion, Water treatment, Methane bacteria, Biological treatment, Anaerobic bacteria, Biochemical oxidation demand, Activated sludge, Sludge disposal, Laboratory tests.

Research on the effects of alum sludge on the process of anaerobic digestion is reported. Working anaerobic sludge from an Auburn sewage treatment plant was used as seed sludge in four laboratory scale anaerobic digestors. The procedure employed simulated a completely-mixed, continuous-flow, no-recycle anaerobic digestion system. Routine analyses were performed on the feed and digesting sludges. Test samples containing very low suspended solids were required for total carbon, total inorganic carbon, volatile acids, nitrates, nitrites, and biochemical oxygen demand (BOD) and COD for digesting sludge. Within six days of the introduction of modified feed sludge, digestors A and D showed signs of failure. It was concluded that this failure was due to the inhibition of methane-forming bacteria, as volatile acid concentration continued to increase. Methane bacteria were not significantly inhibited by the aluminum ion in digester C, suggesting another cause of toxicity. It was hypothesized that the sulfide in the sludge inhibited the methane bacteria. Water treat-

ment plant sludge decreased COD and phosphate levels in the digesting sludge supernatant; TOC and BOD were basically unaffected. Alkalinity and pH decreased for the digesting sludge. (Davison-IPA)
W79-04115

EFFECTS OF ALUM WATER TREATMENT SLUDGE ON DOMESTIC WASTEWATER SLUDGES,
Auburn Univ., AL.
M. E. Burman, III.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 889, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, December 10, 1975. 105 p, 6 fig, 24 tab, 36 ref, 1 append. OWRT-A-040-ALA(5).

Descriptors: *Waste treatment, *Alum sludge, *Activated sludge, *Sewage treatment, Sewage sludge, Sludge treatment, Municipal wastes, Waste treatment, Filtration, Aerobic treatment, Laboratory tests, Sewage, Phosphates.

Research on the effects of alum sludge generated by water treatment plants on the properties of domestic waste water sludges is reported. Phase I of the three phase investigation was concerned with the effects of raw sewage containing alum sludge on an activated sludge batch process. Phase II investigated the effects of alum sludge on waste activated sludge undergoing aerobic digestion. Phase III involved a series of filtrations performed on primary sewage sludge-alum sludge mixtures. The presence of alum sludge in raw sewage decreased raw primary sludge specific resistance, but did not affect the specific resistance of the activated sludge used in treating that sewage. An increase in specific resistance of waste activated sludge containing alum sludge was shown at the beginning of the digestion period. Phosphate analysis, performed on waste activated sludge filtration during digestion, showed that alum sludge effectively removed phosphates from the filtrate. Results of the series of filtrations indicated that specific resistance decreases and sludge compressibility increases when alum sludge is mixed with primary sewage sludge. (Davison-IPA)
W79-04116

WASTEWATER TREATMENT FOR SMALL RURAL COMMUNITIES,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
C. E. Parker.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 904, Price codes: A02 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg. Completion report, 1973. 15 p, 2 fig, 2 tab, 10 ref. OWRT-A-052-VA(1).

Descriptors: Algae, *Waste water treatment, *Waste storage, *Oxidation lagoons, Dissolved oxygen, Rural communities, *Aeration.

A laboratory study using algal growth units was used to determine the parameter responsible for flotation of algal cells coagulated with aluminum sulfate. The effect of mixing was also studied and these results were used to evaluate process design for chemically treated lagoon effluent. In addition, cost comparisons between extended aeration with chemical-physical treatment and lagoon treatment followed by the chemical-physical treatment were made. Dissolved oxygen was found to be the parameter than can be used to control sedimentation under field operating conditions. By maintaining a lagoon effluent with dissolved oxygen less than 50% saturation, sedimentation can be assured. Mixing variations did not appreciably affect the ability to float, only the time required to produce flotation. Design parameters used in conventional water treatment plant design seem to be reasonable for designing algal coagulation, sedimentation, and filtration facilities. The use of lagoons followed by chemical-physical treatment is comparable economically to extended aeration treatment up to a population of 500. For populations up to 5000 lagoon-chemical-physical treatment will result in an initial cost burden 50% less than extended aeration followed by chemical-physical treatment. Therefore, where phosphorus and nitrogen reductions are desirable, lagoon-chemical-physical treatment offers a considerable economic advantage to the small community.
W79-04119

SURFACE-TREATED ACTIVATED CARBON FOR REMOVAL OF AMMONIA FROM WATER.
Pennsylvania State Univ., University Park, PA. Dept. of Material Sciences.
O. P. Mahajan, A. Youssef, and P. L. Walker, Jr.
Separation Science and Technology, Vol 13, No. 6, p 487-499, 1978. 4 tab. OWRT-A-043-PA(1), 14-34-0001-6039.

Descriptors: Following oxidation, pH values of aqueous carbon suspensions decrease appreciably with a concomitant increase in their ammonia absorption capacities. Oxidative treatment with nitric acid is most effective for enhancing ammonia adsorption capacity of a carbon. Irrespective of the oxidative treatment, the relative concentration of carboxylic, lactonic, and phenolic groups on different oxidized carbons is more or less constant. Breakthrough curves have been measured at different flow rates for two oxidized carbons. Bed capacities are essentially constant after the first cycle and could be regenerated with 0.1 N HCl. (Sink-Penn State)

As-received commercial activated carbons do not adsorb noticeable amounts of ammonia from aqueous solution.
W79-04132

UPPER TRINITY RIVER BASIN COMPREHENSIVE SEWERAGE PLAN, VOLUME I.
Camp, Dresser, and McKee, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 540, Price codes: A19 in paper copy, A01 in microfiche. Report to the North Central Texas Regional Planning Commission, July 1970. 13 sections, 36 fig, 73 p. See also Volume 2 - Appendix.

Descriptors: *Waste water treatment, *Waste water(Pollution), *Regional analysis, *Planning, *Treatment facilities, *Water supply, *Dallas(TX), *Fort Worth(TX), Texas, Waste water disposal, Water pollution, Water pollution treatment, Water demand, Water quality, Water reuse, Sewage treatment, Financing, Institutions, Administration, Cost analysis, Construction, Sewage disposal, Pollution control, Structural alternatives, Upper Trinity River Basin(TX).

The study's objective was the preparation of an area-wide comprehensive sewerage system and program both for interceptor and trunk sewers and for sewage treatment and disposal facilities in the North Central Texas region. Methods for plan implementation are suggested. The study area is about 11,000 square miles--larger and more populous than several states. Included are Dallas and Fort Worth and about 20% of the state's population. Six large joint use wastewater treatment plants are proposed in the Dallas-Fort Worth metropolitan area. The improved conveyance and treatment facilities are expected to raise associated costs threefold for residents. However, much of this burden is expected to be eased by federal and state grants. The report also recommends further study of problems such as agricultural runoff, storm runoff, septic tank use, infiltration into collection systems, and wastewater reuse. Specifically, reviewed in the report are water quality considerations, existing facilities, quantity and quality of sewage flow, design and costing criteria, costing estimates, alternative regional systems, the final recommended regional alternative and administration, and financing of the selected plan. (See also W79-04136) (Zayac-NC)
W79-04135

UPPER TRINITY RIVER BASIN COMPREHENSIVE SEWERAGE PLAN, VOLUME 2: APPENDIX.
Camp, Dresser, and McKee, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 541, Price codes: A11 in paper copy, A01 in microfiche. Report to the North Central Texas Council of Governments, July 1970, second of two volumes. 237 p, Appendices A through I.

Descriptors: *Wastewater treatment, *Industrial wastes, *Soil classification, *Linear programming, *Low-flow augmentation, *Dallas(TX), *Fort Worth(TX), *Wastewater treatment plants, *Questionnaires, *Trunk sewers, Wastewater(Pollution, Texas, Sewers, Water quality, Treatment facilities, Sewage disposal, Waste water treatment plant operators.

This volume contains 9 appendices to the Comprehensive Sewerage Plan for the Upper Trinity River Basin. The objective of the study, as set out in the main report, was to prepare an area-wide comprehensive sewerage system and program for the North Central Texas region. Appendix A presents Texas water quality requirements applicable to the Trinity River as abstracted from 'Water Quality Requirements: Volume 1, Inland Waters', published by the Texas Water Quality Board, June 1967 and 'Water Quality Standards Summary', September 1969. Appendices B and C are questionnaires for major wastewater treatment plant operators, and industrial waste dischargers, respectively. Appendix D presents information on existing trunk sewers in the study area. The sewers included are primarily those carrying sewage flows from one population center to another for treatment, or which convey flows for more than one community. Appendix E is a soils legend for the study area; Appendix F outlines linear programming procedures; and Appendix G reviews procedures for estimating low flow augmentation requirements. Appendix H is a glossary; Appendix I is a bibliography. (See also W79-04135) (Zayac-NC)
W79-04136

INVESTIGATION OF THE LONG-TERM EFFECTS OF CHLORINE ON THE OXYGEN DEMAND OF WASTEWATERS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. C. Young, and C. D. McCallion.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 161, Price codes: A07 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Iowa State University, Completion Report, ISWRRI-88, September 1977. 129 p, 26 fig, 8 tab, 58 ref, 3 apend. OWRT A-060-IA(1).

Descriptors: *Chlorination, *Biochemica oxygen demand, *Nitrification, Oxygen sag, Oxygen demand.

Studies of the long-term effect of chlorination on wastewaters have shown that the effect primarily is to reduce the rate of biochemical oxidation of organic material rather than to oxidize the organics chemically. This reduction in rate gives the appearance of reducing the biochemical oxygen demand; but upon reseeding, as by mixing with river water, the full oxygen demand of the wastewater is exerted. Nitrification does not seem to begin in the presence of chlorine; but when the free and combined residual is dissipated, nitrification can occur and tends to proceed at a rate equal to that in unchlorinated samples. The research results indicate that chlorination of secondary effluents may delay nitrification in streams until the wastewater reaches a second discharge point downstream where the nitrogenous oxygen demand of both wastewaters may then be superimposed, essentially compounding the oxygen sag problems downstream of the second discharge point.
W79-04160

ESCANABA'S ENVIRONMENTAL SYSTEMS: THE FIRST FIVE YEARS,

Iead Paper Co., Escanaba, MI.
. L. Parr.
'IMA (Paper Industry Management Association) Iagazine, Vol. 60, No. 9, p 14-15, September, 978. 1 illus.

)escriptors: *Pulp wastes, *Waste water treatent, Biological treatment, Waste, Industrial astes, Water pollution sources, Water pollution eatment, Waste treatment, Pulp and paper indusy, Effluents, Odor, Aerated lagoons, Oxygen, lutrients, Aeration, Water conservation, Michian, Sodium sulfate, Air pollution control, Kraft ills, Clarifiers.

Iead Paper Co.'s kraft mill at Escanaba, Michian, has successfully eliminated saltcake emissions y the addition of low-energy wet scrubbers in eries with the recovery boiler precipitator, and dor problems have been prevented during normal perations. Occasional odors are from the effluent eatment system. The 10-day treatment time is rovided by two lagoons in series, and the first goon has been subject to occasional odor probms associated with oxygen depletion. This has een improved by changing the point of nutrient ldition to the inlet of the second lagoon and by roviding additional aeration in the first lagoon. ffluent from the lagoons flows to a secondary arifier. The mill has continuously met all river uality criteria. A water conservation program is progress with the goal of reducing water conmption by one-third, and effluent treatment imrovement trials are being conducted. (Louden-PC)
'79-04219

IMITING THE COSTS OF POLLUTION CONROL: TREATMENT OF EFFLUENTS AT THE OURCE (LIMITATION DU COUT DE LA DEOLLUTION: TRAITEMENT DES EFFLUENTS LA SOURCE),
stitut National de Recherche Chimique Appliiee, Paris (France).
Jager-Forget.
apier, Carton et Cellulose, Vol. 27, No. 7, p 44-, July, 1978. 2 fig, 1 illus, 3 ref.

escriptors: *Pulp wastes, *Waste water treatent, Wastes, Industrial wastes, Water pollution eatment, Waste treatment, Water pollution urces, Pulp and Paper industry, Effluents, Comned sewers, Separated sewers, Biochemical ygen demand, Biological treatment, Water poltion control, Costs, Condensates, Black liquor.

brief examination is presented of the advantage a general treatment of mill effluents vs. those of parate treatment of different effluents in specialed stages. For instance, in a pulp mill in which e evaporator condensates represent 55% of the OD load of the total effluents but only 1.5% of e volume, sparate biological pretreatment of ese condensates can reduce overall pollution ntrol costs significantly. Another example is ed in which a pulp mill has a general effluent th a volume of 8,750 cu m/day and a load of 75 tons/day as well as black liquors with a lume of 300 cu m/day and a load of 6.0 tons/y. Here, single-stage combined treatment would pear to be preferable. (Speckhard-IPC)
79-04221

HAT'S NEW IN FLOTATION. (QUOI DE EUF EN FLOTTATION),
Besse.
pier, Carton et Cellulose, Vol. 27, No. 7, p 42-, July, 1978. 7 fig.

escriptors: *Pulp wastes, *Waste water treatent, *Treatment facilities, *Flotation, Fiber reovery, Filler recovery, Pulp and paper industry, fluents, Water pollution treatment, Water pollun sources.

brief description is given of Krofta Engineering rp.'s Supercell flotation unit for treatment of ste waters. The unit can be used, for example, in recovery of papermaking fibers and fillers. peckhard-IPC)

W79-04224

THE REMOVAL OF COLOR FROM EFFLUENT USING VARIOUS ADSORBENTS: SOME PRELIMINARY ECONOMIC CONSIDERATIONS,
Queen's Univ., Belfast (Northern Ireland). Dept. of Industrial Chemistry.
G. McKay, M. S. Otterburn, and A. G. Sweeney.
Journal of the Society of Dyers and Colourists, Vol. 94, No. 8, p 357-360, August, 1978. 4 fig, 18 ref, 4 tab.

Descriptors: *Waste water treatment, *Decoloring, *Textiles, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Dyes, Carbon, Peat, Adsorption, Costs, Model studies, Economics, Clays, Silica, Color, Wood, Aluminum oxide.

A series of isotherms were used to study the adsorption of Telon Blue ANL (C.I. Acid Blue 25), Astrazone Blue FRR (C.I. Basic Blue 69), Chlorazol Sky Blue FFS (C.I. Direct Blue 1), and Cibacet Turquoise Blue G (C.I. Disperse Blue 7) on various adsorbents (carbon, fuller's earth, silica, wood, peat, and alumina). Experimental conditions were selected so that the isotherms reached a plateau and so that the saturation value of the adsorptive capacity (mg of dye adsorbed per g of adsorbent) could be determined. The values were used to assess the quantity of adsorbent required to remove 1 kg of dye. These quantities have been used as a basis for costing the adsorption process. The results indicate that carbon has the highest adsorptive capacity, but an economic model shows that peat and wood may also be used since they too have high adsorptive capacities while being much cheaper. (Witt-IPC)
W79-04253

TOXICITY REMOVED BY FOAM SEPARATION,
British Columbia Research Council, Vancouver.
K. S. Ng, L. A. Gutierrez, and J. C. Mueller.
Industrial Wastes, Vol. 24, No. 5, p 36-38, 40-41, September/October, 1978.

Descriptors: *Pulp wastes, *Waste water treatment, *Detoxification, *Foam separation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Toxicity, Pilot plants, Canada, Aeration, Bubbles, Foaming, Nozzles, Turbines, Collapse, Equations, Foreign countries, Kraft mills, Bleached pulp mills, Pollution abatement.

The performance of foam separation in removing toxic substances from pulp mill effluents was studied in a 450 cu m/day (100,000 gal/day) pilot plant at two bleached kraft mills in British Columbia. Jet aerators were used for foam generation and turbines for foam breaking. The jet aerator consistently produced fine bubbles and generated sufficient gas-liquor interface for toxicity adsorption. Mean bubble size increased from 0.015 mm at 0.03 cu m/min of air load per jet and approached 1.2 mm at air loads exceeding 0.6 cu m/min. A 5-cm-diameter jet aerator operating at maximum design air load of 1.4 cu m/min (1.2 mm mean bubble size) was calculated to produce approximately 4,7-00 sq m/cu m air interfacial area. A 31-cm-diameter 3-blade vaned disk turbine effectively collapsed up to 1.4 cu m/min of foam. Foam breaking capacity and power consumption can be predicted by the two equations given. The minimal gas-liquid interfacial area necessary for detoxification of bleached kraft mill effluent was determined at 7 sq m/liter and 40 sq m/liter for the two mills. Detoxification success rates over prolonged operation time of a 3-stage system were 89 and 84%, respectively. (Witt-IPC)
W79-04254

PHYSICO-CHEMICAL TECHNIQUES FOR TREATING MILL EFFLUENTS: A STATE-OF-THE-ART REVIEW,
PPRIC, Pulp and Paper Research Inst. of Canada, Pointe Claire (Quebec).
A. Wong, and S. Prahacs.
Pulp and Paper Canada, Vol. 78, p 63-67, July, 1977. 2 fig, 6 tab, 28 ref.

Descriptors: *Pulp wastes, *Pulp and paper industry, *Adsorption, *Ion exchange, *Separation techniques, Coagulation, Flocculation, Chemical precipitation, Activated carbon, Biochemical oxygen demand, Industrial wastes, Color, Toxicity, Lime, Ozone, Waste water treatment, Effluents, Physical-chemical treatment.

Applications of physico-chemical treatment techniques for the reduction of toxicity, color, and BOD of bleached kraft mill effluents are discussed. The basic techniques used for pulp and paper mill effluents include adsorption, ion exchange, coagulation, flocculation, precipitation, adsorptive bubble, and membrane separation. Various methods for the detoxification of pulp and paper effluents are described. The PPRIC carbon treatment process includes the addition of powdered activated carbon, aeration, the addition of settling agents, and clarification. Granular carbon adsorption is based on the use of carbon-packed filter columns. Foam separation involves the adsorption of surface active toxicants on gas bubbles rising through the effluent. Lime treatment and chemical flocculation using alum with and without a polyelectrolyte are discussed. Decolorization processes are reviewed, including ultra-filtration, ozone, solids contact processes, ion exchange, and biological treatment. Current research on the use of physico-chemical treatment to reduce BOD is described. (Schulz-FIRL)
W79-04256

TERTIARY TREATMENT OF EFFLUENTS BY FILTRATION,
Schumachersche Fabrik, Bietigheim (Germany, F.R.).
H. J. Schmidt-Holthausen.
Filtration and Separation, Vol. 15, No. 4, p 350, 352, 367, July/August, 1978. 1 fig, 1 tab.

Descriptors: *Waste water treatment, *Filtration, *Tertiary treatment, Waste treatment, Water purification, Water pollution control, Water pollution treatment, Industrial wastes, Wastes, Separation techniques, Filters, Effluents.

Following mechanical and biological treatments of effluents, a third or even fourth stage for further purification is now being used or considered in some areas, including industrial water pollution control. Filtration processes as 3rd- or 4th-stage methods are said to offer cost-effective performance. Two such processes are described in some detail, namely (1) filtration by a separating layer having pores smaller than the deposited particle diameter (including two-layer filter materials, quartz sand depth filters, etc.), and (2) percolating filtration (bottom-to-top flow, and combination upward/downward filtration). (Brown-IPC)
W79-04279

THE FILTER BELT PRESS -- APPLICATION AND DESIGN,
Simon-Hartley Ltd., Stoke on Trent (England).
E. P. Austin.
Filtration and Separation, Vol. 15, No. 4, p 320-322, 324, 326, 329-330, July/August, 1978. 5 fig, 2 illus, 1 tab.

Descriptors: *Presses, *Sludge treatment, *Dewatering, Wastes, Waste treatment, Water pollution treatment, Water pollution sources, Design, Polymers, Chemicals, Operation and maintenance, Sludge, Equipment, Belt presses.

Activity in the field of belt-press design has accelerated rapidly over the past 5 yr. The many designs currently available owe their existence to the availability of polymeric chemicals which promote release of free water from the solid phase. Most belt presses rely on the production of a sandwich of sludge between two mesh belts which is subsequently subjected to various forces to squeeze out the water. The layout of the roller trains through which the sandwich has to pass varies considerably

and, all other factors being equal (which is not the case), would appear to be the only distinguishing variable between probably 20 or more types of machines. Discussed are dewatering principles, stages in the operation of a belt press, and machinery design. (Louden-IPC)
W79-04286

ENSO-BIOX METHOD FOR DEODORIZATION AND DETOXIFICATION OF WASTE WATERS,
Enso-Gutzeit Osakeyhtio, Imatra (Finland).
J. Kreula, L. Silakoski, and A. Vesanto.
Empire State Paper Research Associates, Invited Papers Presented at the Spring Meeting, April 3-5, 1978, Mobile, Alabama, p 35-50. 5 fig, 4 ref, 3 tab. Empire State Paper Research Institute, Syracuse, New York.

Descriptors: *Pulp wastes, *Waste water treatment, *Biological treatment, Oxidation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Food processing industry, Effluents, Odors, Toxicity, Sulfur compounds, Microorganisms, Bark, Trickling filters, Filters, Solids contact processes, Yeasts, Poultry, Kraft mills, Detoxification, Condensates, Blood, Foreign countries, Europe, Finland.

A biofilter method developed from the pioneering work of O. Koistinen at Enso-Gutzeit Oy. in Finland oxidizes malodorous and/or toxic sulfur compounds through the action of microorganisms living on the bark filling of trickling filters. Historical, theoretical, and practical aspects of the process are outlined. Originally intended for treatment of kraft-mill condensates, the Enso-Biox process has been applied also to the purification of yeast factory effluents and of odiferous condensates from the hydrolysis of poultry feathers, blood, and other slaughterhouse residues used to make animal-fodder protein. The earliest full-scale commercial Biox installation started up in 1967 at the Uimaharji kraft mill, (Finland) which has a daily capacity of 350 metric tons of bleached kraft pine and birch pulp. Although market fluctuations caused several mill shutdowns even those occasioned during winter did not damage the biofilters which regained normal effectiveness within a few days after a restart. (Brown-IPC)
W79-04295

EXPERIENCE WITH THE OPERATION OF AN EFFLUENT CLARIFIER (EXPERIENCE D'OPERATION D'UN CLARIFICATEUR D'EFFLUENTS),
Price Co. Ltd., Alma (Quebec).
M. Langlois.
Canadian Pulp and Paper Association Summer Technology Conference, May 31-June 3, 1978, Pointe-Au-Pic, Quebec, Canada, Preprints, p F1-F5.

Descriptors: *Pulp wastes, *Waste water treatment, *Clarifiers, *Operation and maintenance, Water pollution treatment, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Waste treatment, Canada, Foreign countries, Sewage, Bearings, Sludge, Operating costs, Costs, Treatment facilities, Newsprint mills.

The effluent clarification system installed at the integrated newsprint mill of Price Co. at Alma, Quebec, is described, and operating experience is reviewed. Covered in particular are the difficulties caused by the presence of sewage in the clarifier and by the use of a metal riddle, means employed for reducing the wear of metal bearings, the possibility for removing sludge at low temperatures during a breakdown in the clarifier drive mechanism, and operating costs. (Speckhard-IPC)
W79-04305

THE EFFECT OF PETROCHEMICAL STRUCTURE ON METHANE FERMENTATION TOXICITY,
Drexel Univ., PA. Environmental Studies Inst.
For primary bibliographic entry see Field 5A.
W79-04315

EFFICIENCY OF CANAL BIODEGRADATION OF PALM OIL SLUDGE AND ITS POLLUTION EFFECTS,
Universiti Sains Malaysia, Penang. Pusat Pengajian Sains Kajihayat.
P. M. Sivalingam, and S. Thavaraj.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 11, p 1229-1237, 1978. 13 fig, 3 tab, 16 ref.

Descriptors: *Biodegradation, *Chemical wastes, *Toxicity, *Waste treatment industrial wastes, Microbial degradation, Biochemical oxygen demand, Carp, Fish physiology, Productivity, Agricultural chemicals, Organic compounds, Bacteria, Biological treatment, Nitrogen, Proteins, *Palm oil.

An investigation on the efficiency of the irrigational biodegradation canal treatment of palm oil mill sludge indicated that there was practically no significant change in its BOD value. Its adverse effects on aquatic organisms such as Cyprinus carpio, Liza subviridis, and Anadara granosa demonstrated the seriousness of the problem. Microbial gas production studies and total microbial counts of the samples indicated activity and bacterial counts to be highest at stations nearest to the factory, excluding that within the premises of the factory proper. Productivity studies of the vegetation adjacent to the biodegradation canal indicated higher productivity at points nearer to the canal itself while productivity decreased progressively towards points farthest from it. This phenomenon is attributed to the large deposition of minerals from sludge into the soil, the lowering in soil pH values, and possibly osmotic capillary processes, resulting in the inhibition of the growth of each organism. Based on these results, it is evident that the problem of organic pollutants from sludge discharged from palm oil mills is yet to be tackled. An alternative treatment method of this agro-waste should be considered to protect the Malaysian aquatic environment from depletion of its protein resources in the very near future. (Deal-EIS)
W79-04332

ANALYSIS OF PRACTICABILITY OF A SOLUTION TO THE PROBLEM OF POLLUTION BY SPENT LIQUORS (ANALYSE DE PRACTICABILITE D'UNE SOLUTION AU PROBLEME DE LA POLLUTION PAR LES LIQUEURS RESIDUELLES),
Quebec Univ., Trois-Rivieres.
R. Rochette, R. Lakshmanan, S. Lakshminarayan, and R. L. Papineau.
Canadian Pulp and Paper Association Summer Technology Conference, May 31-June 3, 1978, Pointe-Au-Pic, Quebec, Canada, Preprints. p E1-E5. 1 fig, 11 ref, 4 tab.

Descriptors: *Pulp wastes, *Proteins, *Waste water treatment, Sulfite liquors, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Pulp and paper industry, Effluents, Costs, Economics, Feeds, Biomass, Water pollution control, Poultry, Return(Monetary), Sulfite pulp mills, Spent sulfite liquor.

Results are presented from a study on the practicability of industrially producing protein from spent sulfite pulping liquor. The animal feed industry constitutes the main outlet for the biomass produced which contains about 38% protein. The poultry industry alone has been able to absorb 66,000,000 lb/yr of biomass which corresponds to the treatment of spent sulfite liquor from the production of 1,800 tons of pulp/day. The costs of operating such an industrial process are estimated at about $16/ton of biomass, which is slightly above the price of soya meal. However, the effect of reducing the pollution-control efforts necessary at a sulfite pulp mill should be taken into account in evaluating the economics of protein production from spent pulping liquor. Data are presented indicating that a mill producing 200 tons of pulp/day could attain an annual level of return (before taxes) of 33% on the investment in a system for biomass production. (Speckhard-IPC)
W79-04400

IDAHO'S ENVIRONMENT (PROBLEM OF UNFETTERED EXPLOITATION RIGHTS V. ENVIRONMENTAL CONCERN),
H. T. Davis.
Environmental Science and Technology, Vol. 12, No. 3, p 276-83, March, 1978.

Descriptors: *Idaho, *Environmental effects, *Exploitation, *Evaluation, State governments, Water pollution sources, Water pollution treatment, Water quality control, Water quality, Streams, Rivers.

Point source pollution problems in Idaho are among the nation's most complex. As one of the last 'old west' states, Idaho faces the problem of unfettered exploitation rights advocated by its traditionally conservative citizens, and opposed by others more environmentally conscious. However, the state legislature is consistently anti-environmental, and has passed only two effective major environmental protection bills in the past six years. Federal agencies such as the Forest Service and Bureau of Land Management are active with environmental programs within the state, but other agencies, such as the Farmers Home Administration, have helped to create problems by funding residential subdivisions contributing to urban sprawl. While the federal Environmental Protection Agency has stated that Idaho's streams have most of the Pacific Northwest's water pollution, federal and state cleanup efforts have recently increased. Air quality is still generally good, but particulate and sulphur dioxide standards are often violated. Mining and smelting activities cause special problems, while logging and livestock adversely affect the ecosystem. Overall, cautious optimism for the future is justified, but progress will be slow. (Rule-Florida)
W79-04421

CITIZENS' COMMITTEE TO PRESERVE LAKE LOGAN V. WILLIAMS (STATE AGENCY'S MAINTENANCE OF WATER QUALITY THROUGH CONTROL OF EFFLUENTS FOUND TOO STRICT),
381 N.E. 2d 661-68 (Ohio Ct. App. 1977).

Descriptors: *Effluents, *Sewage treatment, *Water quality standards, *Ohio, Permits, Water pollution, Environmental effects, Technology, Lakes, Regulation, Discharge(Water), Surface waters.

The Ohio Environmental Board of Review (EBR) ordered the state Director of Environmental Protection to modify effluent limitations contained in a permit issued for the construction of a sewage treatment plant. The EPR order in effect modified the permit to the extent that any discharge of effluent could not degrade the water below the existing water quality of the receiving waters. The director appealed the order. Reversing the order, the appeals court held that the Review Board had erred in failing to make findings as to whether the technology used in the sewage treatment plant would provide the most effective treatment available under existing technology and as to whether discharge of effluents from the plant would be in compliance with general water quality standards and would not cause significant degradation of a nearby lake. The court stated that the proper test was that of 'significant degradation,' a standard lower than that required by the Review Board. After examining the applicable regulations, the Court decided that a matching of the water quality of the discharged water and the receiving waters was not to be required. (Hucks-Florida)
W79-04430

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

ESSATION OF RETURN FLOW AS A MEANS OF COMPLYING WITH POLLUTION CONROL LAWS,
or primary bibliographic entry see Field 6E.
V79-04445

EDERAL WATER POLLUTION CONTROL CT AMENDMENTS OF 1977 (SEATTLE, VASH.).
or primary bibliographic entry see Field 6E.
V79-04457

IETHOD FOR THE PURIFICATION OF EWAGE WATERS WHICH CONTAIN ORANIC COMPOUNDS OF AN ANIONIC ATURE,
nic, S.p.A., Palermo (Italy). (Assignee).
. Fusco.
.S. Patent No. 4,120,789, 5 p, 2 tab, 4 ref; Official azette of the United States Patent Office, Vol 75, No 3, p 1101, October 17, 1978.

escriptors: *Patents, *Waste water treatment, Sewage treatment, Industrial wastes, Organic astes, Water pollution treatment, Chemical prepitation, Dyes, Separation techniques.

he purification of sewage waters containing siultaneously dyestuffs and capillary-active subances such as the sewage waters of dyeing installions, can be efficiently be achieved by employg bis-guanylhydrazonium- and isguanylhydrazonium salts. These salts form, ith anionic compounds, saline derivatives which e very poorly water-soluble so that they can sily be removed. (Sinha-OEIS)
V79-04463

RGANIC WASTE DRYING PROCESS,
niversal Oil Products Co., Des Plaines, IL. (Asgnee).
. Maffet.
.S. Patent No. 4,121,349, 7 p, 1 fig, 4 ref; Official azette of the United States Patent Office, Vol 75, No 4, p 1299-1230, October 24, 1978.

escriptors: *Patents, *Waste water treatment, Sewage treatment, Sludge treatment, Water poltion treatment, Organic wastes, Adsorption, rying, Solid wastes, Fertilizers, Separation techques, Volatile hydrocarbons.

process for drying organic waste comprises the eps of passing an organic waste stream containing least 20 wt.% water, volatile liquid hydrocarons, and organic waste into a toroidal drying zone d effecting the vaporization of water and hydrrbons and the formation of a drying zone effut stream; admixing the solids recycle stream into e drying zone effluent stream at adsorption-proting conditions; separating the drying zone efuent stream into a vapor stream and a dry solids eam containing less than 15 wt.% water; admixg a first portion of the dry solids stream into the ying zone effluent stream as the solids recycle eam; and forming a second portion of the dry lids stream into particles by extrusion. The unrecled portion of dry solids extruded from comcted granules having good flow characteristics d suitable for application by commercial fertilizspreaders. (Sinha-OEIS)
79-04464

ATER PURIFICATION WITH FRAGMENTD OIL SHALE,
S. Kilburn.
S. Patent No. 4,121,662, 7 p, 1 fig, 14 ref; Official azette of the United States Patent Office, Vol. 5. No. 4, p 1406, October 24, 1978.

escriptors: *Patents, *Waste water treatment, Water pollution treatment, *Organic wastes, Oil ales, Filtration, Separation techniques, Oil shale torting, Hydrocarbon recovery, Steam generator ow-down.

apurities are removed from impure water by roducing the impure water into a fragmented permeable mass of particles containing raw oil shale. The water introduced can be water containing hydrocarbons such as water obtained from retorting oil shale or water containing suspended solids such as blowdown from a steam generator. After introducing impure water into the fragmented permeable mass, the mass of particles can be retorted. This is particularly advantageous when the introduced water contains hydrocarbons because at least part of the hydrocarbons removed from impure water can be recovered by retorting. Preferably the fragmented permeable mass of particles is contained in an in situ oil shale retort in a subterranean formation containing oil shale because of environmental considerations. Since the fragmented mass containing oil shale remains in place under ground, the chance of surface contamination by the impurities removed from the water is reduced. (Sinha-OEIS)
W79-04465

PROCESS FOR TREATING SEWAGE, PARTICULARLY ON SHIPS,
H. G. Krugmann.
U.S. Patent No. 4,121,993, 6 p, 2 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 975, No 4, p 1512, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Sewage treatment, Electrolysis, Separation techniques, Ships, Equipment.

A process, particularly suitable in connection with the conditions which occur on board ships facilities the separation of impurities contained in the sewage from the water in an apparatus of limited dimensions so that the impurities can be removed permitting the water to be discharged outside the ship in a sufficiently pure form to prevent any harmful pollution of the surrounding waters. The problem is solved in that the sewage undergoes electrolysis so that the impurities assume a specific gravity differing from that of the water, leading to a spontaneous separation of the solids from the water through sinking or floating, following which the impurities are removed and eliminated alone and the clarified sewage can be discharged outside the ship. The apparatus comprises a detritus chamber, a metering and comminuting pump, a chemical container, a preliminary sedimentation tank, an electro-reactor vessel and a final sedimentation tank and sludge container attached in configuration and in parallel in the form of a compact unit in a common supporting frame. (Sinha-OEIS)
W79-04470

METHOD OF RESOLVING A MIXTURE OF OIL, WATER, AND SOLIDS,
Texaco Inc., New York. (Assignee).
F. Tao, and J. E. Warner.
U.S. Patent No. 4,122,009, 7 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 975, No 4, p 1516, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oily water, Separation techniques, Oil industry, Baffles, Coalescence, Secondary Recovery(Oil), Solid wastes, Oil recovery.

A method for resolving a mixture of oil, water and solids includes flowing the mixture under and over two forwardly inclined baffles for settling out the solids and for causing oil drops to rise, collect, and flow in V-shaped grooves in the under side of the two baffles for coalescing the drops of oil into larger globs. The final steps of flowing the mixture over the upper forwardly declining baffle leave all coaslesced oil on the surface for being drawn off as solids-free and water-free oil, and draw off water between the oil outlet and the solids outlet for producing oil-free and solids-free water. (Sinha-OEIS)
W79-04471

SEWAGE TREATMENT SYSTEM,
J. W. Greenleaf, Jr., and H. E. Schmidt.
U.S. Patent No. 4,122,013, 10 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1517-1518, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Anaerobic conditions, Anaerobic bacteria, Aerobic conditions, Oxidation, Nutrient removal, Sewerage.

A sewage treatment system is divided into two stages with a collection system dispersed between them. The first stage includes anoxic treatment units producing an anaerobic effluent which is moved through the vacuum tight collection system to the second stage of treatment including an oxidation unit producing an aerobic effluent containing nitrates, dissolved oxygen and activated sludge. The two liquids are mixed in a chamber and are subjected to treatment before discharge for producing a highly treated effluent from which a major part of the nutrients have been removed. (Sinha-OEIS)
W79-04473

SETTLING TANK,
Texaco Inc., New York. (Assignee).
F. Tao, and J. E. Warner.
U.S. Patent No. 4,122,016, 8 p, 4 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1519, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oil pollution, Separation techniques, Settling basins, Baffles, Coalescence, Oil industry, Equipment, Secondary recovery(Oil), Oil recovery.

In oil fields environmental considerations require that the oil content of the produced water be reduced to an acceptable level, no more than 150-200 ppm of oil in the water discharged into rivers or streams nearby. Also clean water is most important for reinjecting into wells for secondary recovery. The primary object of this invention is to provide an improved settling tank for resolving a mixture of oil, water, and solids from an oil and solids-in-water influent. The settling tank includes two inclined and parallel baffles about which the influent water successively passes. Each baffle preferably has parallel V-shaped grooves in the under surface for entrapping, guiding, and coalescing the oil droplets into large globs for channeling and passing through the openinings between the baffles and the tank wall for rising to the surface for draw off. The clear water outlet is positioned on a horizontal plane intermediate horizontal planes through the low forward end of the upper baffle and the high rear end to ensure delivery of an oil-free and solids-free water. An upper oil outlet ensures delivery of a solids-free and water-free oil from the settling tank. (Sinha-OEIS)
W79-04474

APPARATUS AND PROCESS FOR TREATING CONTAMINATED WATER,
Sulzer Brs. Ltd., Winterthur (Switzerland). (Assignee).
J. Gnieser, and L. Pelloni.
U.S. Patent No. 4,123,341, 5 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 975, No 5, p 1969, October 31, 1978.

Descriptors: *Patents, *Water pollution treatment, *Industrial wastes, *Suspended solids, Turbidity, Electrodes, Coagulation, Separation techniques, Electrolytes, Conductivity, Equipment.

The process comprises the steps of passing contaminated water through an inlet line into an electrical field in an electro-coagulator to discharge the electrically-charged particles in the water while simultaneously dissociating at least some of the water, and coagulating the discharge particles and thereafter separating the coagulated particles from the water in a flotation stage while removing a flow of clarified water through an outlet line. The apparatus is provided with one or more turbidity meters in the inlet line to the electrocoagulator and the outlet line from the flotation state. The voltage across the coagulator electrodes is con-

trolled in response to a controller which receives signals from the respective turbidity meters. When the turbidity increases in either the inlet line or outlet line, the voltage is increased and when the turbidity decreases, the voltage decreases. In addition, upon an increase in voltage above a top limit, compressed air is charged into the coagulator while the rate of flow of recycled sludge is increased. Pressure in the coagulator is maintained during operation of the air compressor. (Sinha-OEIS)
W79-04477

METHOD AND APPARATUS FOR TREATING METAL CONTAINING WASTE WATER,
Gotzelmann KG Industrieabwasser-Anlagen, Stuttgart (Germany, F.R.). (Assignee).
R. Kammel, and H. Lieber.
U.S. Patent No. 4,123,340, 9 p, 2 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 975, No 5, p 1969, October 31, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, Separation techniques, Electrolysis, Metals, Equipment, Product recovery.

A process is described in which it is possible to almost completely demetallize metal-containing waste waters, where the metals are recovered without the use of chemicals in a form enabling them to be reused directly. The method for treating metal containing waste water employes a vessel in which there is provided at least one anode and a cathode consisting essentially of electrically conductive particles. The waste water is subjected to electrolysis during which the waste water and the particles of the cathode are being moved. The particles of the cathode are arranged in a cage closed on all sides whose walls are perforated. The cage is moved by an external force during the electrolysis in order to move the particles. The waste water is simultaneously moved by producing a forced flow through the particles. An apparatus is provided for practicing the method. (Sinha-OEIS)
W79-04478

METHOD OF REMOVING OIL FROM WATER,
Exxon Production Research Co., Houston, TX. (Assignee).
R. E. Williams.
U.S. Patent No. 4,123,354, 7 p, 2 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 975, No 5, p 1973, October 31, 1978.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, *Water quality control, *Oily water, Separation techniques, Absorption, Offshore platforms, Equipment, Outer Continental Shelf, Offshore petroleum industry.

A method for use in offshore operations is described whereby oil and water mixtures produced from an offshore well can be separated to permit the discharge of water into the sea. The oil and water mixture is injected into a partially submerged, vertical pipe and is contacted by an endless oleophilic, fibrous cord which is drawn through the pipe and which selectively removes the oil droplets from the waste water. The fibrous cord is drawn upwardly through the pipe in a direction counter-current to the flow of waste water. Oil which coalesces on the fibrous cord is squeezed from the cord at the surface while clarified waste water is discharged from the lower end of the pipe. Oil is removed from the fibrous cord by passing it through counter rotating rollers which compress the cord and squeeze the sorbed oil from it. (Sinha-OEIS)
W79-04479

SIMULTANEOUS TREATMENT OF SO2 CONTAINING STACK GASES AND WASTE WATER,
National Aeronautics and Space Administration, Washington, DC.
R. A. Frosch, J. C. Poradek, and D. D. Collins.
U.S. Patent No. 4,123,355, 6 p, 1 fig, 2 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1973, October 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Air pollution, Pollution abatement, Separationtechniques, Sulfur compounds, Hydrogen ion concentration, Oxidation, Recycling, Stack gases, Sulfur dioxide, Scrubbers.

A portion of a sulfur dioxide containing gas stream, e.g., a stack gas, and a portion of a waste water stream such as derived domestic sewage is introduced into a first scrubbing zone, the waste water containing from about 500 to about 1200 parts per million iron. The first scrubbing zone is at a relatively low pH and an elevated temperature. The contact time in the first scrubbing zone is sufficient to permit substantial oxidation of absorbed SO2. The first scrubbing zone is essentially a closed loop system in which the waste water is continuously recycled through the scrubber. However, a portion, e.g. a slip stream, of the recirculating waste water in the first scrubbing zone is introduced, together with a second portion of the gas stream and a second portion of the waste water into a second scrubbing zone. The waste water in the second scrubbing zone contains an iron content lower than that in the first scrubbing zone. The SO2 introduced into he second scrubbing zone acidifies the waste water to reduce the bacteria to acceptable discharge levels after which the acidified waste water is treated to remove solids originally present. (Sinha-OEIS)
W79-04480

SEPTIC SYSTEM LIQUID LEVEL CONTROL APPARATUS,
B. Flagge.
U.S. Patent No. 4,123,358, 8 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1974-1975, October 31, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Septic tanks, Water levels, Flow control, Equipment, Degradation(Decomposition), Biodegradation.

Automatic liquid volume compensation apparatus is disclosed having particular application to septic systems. The apparatus limits septic tank air volume to optimize bacterial decomposition of wastes and controls the flow rate from the inlet piping through the tank to the drain field to limit passage of unprocessed fluid and prevent backups in the inlet piping. The first of two embodiments, a bladder within a settling tank inflates or deflates to accommodate changes in liquid volume while maintaining tank level within desired limits. In the second embodiment, an auxiliary tank stores excess liquid which is returned to the primary settling tank when settling tank liquid level has declined to a desired height. (Sinha-OEIS)
W79-04481

RECENT EFFLUENT COLOR REDUCTION TRIALS AT ALBERNI PULP AND PAPER,
Macmillan Bloedel Ltd., Nanimo (British Columbia).
R. W. Cunnington.
In Canadian Pulp and Paper Association Technical Section, Spring Conference, May 17-21, 1978, Jasper, Alberta, Preprint Proceedings, p 82-88. 5 fig, 2 ref, 6 tab.

Descriptors: *Bleaching wastes, *Color, *Surface waters, Water pollution effects, Wastes, Industrial wastes, Water pollution sources, Hydrogen ion concentration, Toxicity, Biochemical oxygen demand, Pulp and paper industry, Effluents, Aerated lagoons, Pulp wastes, Canada, Foreign countries, Newspring mills, Kraft mills.

Measurable improvements in effluent and receiving water color (about 50%) effluent pH variation, toxicity, and 5-day BOD were achieved at the Alberni Pulp and Paper Division of MacMillan Bloedel Ltd. (British Columbia) by HEH (as opposed to CEH) bleaching of the kraft newsprint furnish. Oxidation of the caustic extraction stage effluent by the addition of calcium hypochlorite reduced the lagoon influent color and had no effect on pH, toxicity, or 5-day BOD. The addition of clarified woodroom effluent to the aerated lagoon increased the color of the aerated lagoon effluent to a greater extent during the oxidation trial than during the HEH bleaching trial. (Swichtenberg-IPC)
W79-04499

5E. Ultimate Disposal Of Wastes

WASTE SURVEILLANCE IN SUBSURFACE DISPOSAL PROJECTS,
Louisiana State Univ., Baton Rouge.
R. Kazmann.
Ground Water, Vol. 12, No. 6, November-December 1974. Presented at the Second National Ground Water Quality Symposium, Denver, Colorado, September 25-27, 1974. 8 p, 9 fig, 14 ref. OWRT-A-002-LA(9), A-011-LA(5), A-022-LA(5), A-027-LA(5), and A-034-LA(1).

Descriptors: *Waste disposal, *Injection wells, Well spacing, Waste disposal wells, Aquifers, Monitoring, Computer programs, Mathematical studies, Equations, Hydrology, Wastes, Laboratory tests.

The monitoring procedures associated with deep-well disposal projects which are being investigated at Louisiana State University (LSU) are examined. The usual monitoring procedure employs an observation well drilled 300 feet or move in the nearest aquifer above the one used for disposal. Any transfer of fluid into the upper aquifer will theoretically show up as a pressure increase in the observation well. Barometric changes affect the rise in pressure caused by the leak and obscuring its detection. It is asserted that exploratory testing and monitoring programs should be designed to evaluate the target aquifer as a waste container to be monitored for many years. The method of computing the volumetric waste capacity of an aquifer is presented. LSU is currently writing a computer program for tracking the spread of wastes in the aquifer after they have been injected. A laboratory sized aquifer, termed a miniaquifer, is being used to verify the computer program. The positioning of monitor wells is of prime importance, and it is concluded that monitor wells should not be placed directly updip from the waste injection well when the density of the waste is greater than the density of the native water. (Davison-IPA)
W79-04097

THE ACCUMULATION AND ELIMINATION OF DIFLUBENZURON BY FISH,
California Univ., Fresno. Mosquito Control Research Lab.
For primary bibliographic entry see Field 5C.
W79-04321

PRODUCTIVE LAND USE OF DREDGED MATERIAL CONTAINMENT AREAS,
Amoco Production Co., Lafayette, LA.
B. S. Hubbard, and J. B. Herbich.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 320-327, 1977. 6 ref, 4 graph.

Descriptors: *Dredging, *Disposal, *Sites, *Land use, Land development, Land reclamation, Agriculture, Industries, Spoil banks, Recreation, Wildlife habitats, Dredged material.

A review of an international list of publications was made to gather examples of locations where dredged material was put to a productive use. A campaign by mail also was made to solicit responses from individuals, companies, and agencies active in the dredging industry around the world. About 150 sites were documented and classified. The categories of uses were commercial, industrial, recreational, wildlife habitats, agricultural, hydraulic control, transportation, research, and multipur-

ose. Analysis of the results indicated that commercial and industrial uses were the most prevant. Maintenance dredging generated the material or a majority of the sites. The owners of the sites ere usually local, state, or national governments. See also W79-04351)(Humphreys-ISWS)
/79-04385

F. Water Treatment and Quality Alteration

ETERMINATION OF THE TECHNICAL POENTIAL OF THE LIME-MAGNESIUM CARONATE PROCESS, VOLUME I,
adian Corp., Austin, TX.
or primary bibliographic entry see Field 3A.
/79-04161

PDATE: WHAT'S IN THE WATER.
ational Water Well Association, Worthington, H.
. R. Richard.
/ater Well Journal, Vol. 33, No. 1, p 84-85, January 1979.

escriptors: *Organic wastes, *Regulation, Water treatment, Water pollution, Epidemiology, rihalomethanes, Carcinagens, Chloroform, Testg procedures, Monitoring, Groundwater.

lthough EPA has not made a decision on its oposed regulations for trace organics in drinking ater, several recent developments are reported. Nassau County, New York, thrity-four of the ounty's 422 public supply wells have been reicted and 259 out of 3000 industrial and comercial plants have been identified as actual or tential discharges or organic compounds. The nerican Water Works Association recommended at the agency consider a maximum contaminant vels of 30 mg/l for chloroform in all public water pplies. The National Drinking Water Advisory ouncil proposed a 'period of research, testing and monstration' of granular activated carbon in mucipal water treatment plants. The National Acadny of Sciences released a report which emphaed that noe of ten epidemiological studies have own that trihalomethanes (THM's) in drinking ater cause cancer. However, NAS believes the HM's in drinking water presents a human health zard. The President's Council on Water and ice Stability called EPA's proposed limitations organics 'costly' and 'inflationary'. Potential urces of organics contamination are listed and ggestions are made to ensure accuracy in testing organics. (Purdin-NWWA)
79-04242

OU NEVER MISS THE WATER ... TILL THE ELL RUNS DRY,
r primary bibliographic entry see Field 6D.
79-04244

'A PROPOSED FAR-REACHING REGULAONS FOR REDUCING SYNTHETIC ORGANS IN DRINKING WATER.
oceedings, American Society of Civil Engineers, urnal of Civil Engineers Division, Vol. 48, No. p 69-71, March, 1978.

escriptors: *Water treatment, *Potable water, /ater purification, *Water quality standards, lorination, Activated carbon, Public health, ater quality control, Standards, Water requirents, Municipal water, Cities.

e Federal Environmental Protection Agency reitly proposed regulations for reducing synthetic ganic chemicals found in drinking water. A ximum contaminant level (MCL) for total trihanethanes (TTHM's) was established, and a treatnt technique using granular activated carbon in water treatment process is now required for ntrol of synthetic organic chemicals. The end ult will reduce the human exposure to chlorom and other THMs in drinking water, which cur as a result of the interaction of chlorine with natural organic substances in raw water. Surface water is more likely than groundwater to produce high THM levels after chlorination. The proposed MCL of 0.10 milligrams per liter for TTHM's in drinking water would initially apply to water systems serving more than 75,000 people. Systems serving populations of 10,000 to 75,000 would only be required to monitor THM levels. Of the 390 community water systems in the U.S. that serve more than 75,000 persons, 60 purchase water from other systems, and 18 do not presently add chlorine. Of the reaming systems, only 86 have TTHM's above 0.10 milligrams per liter. Thus, only these systems would have to make process changes and/or add carbon treatment. (Rule-Florida)
W79-04422

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
For primary bibliographic entry see Field 6E.
W79-04457

WATER PURIFYING SYSTEM AND PUMP THEREFOR,
J. D. Smith.
U.S. Patent No. 4,123,359, 6 p, 3 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1975, October 31, 1978.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Aeration, Bacteria, Cultures, Equipment.

The object is to provide a new and improved water purifying system and a pump which requires little or no cleaning operations, and having a relatively high flow rate without having the wetted surfaces being composed of corrosive materials. The system generally comprises a porous bag containing a mixture of natural ingredients resting on the top surface of a perforated plastic plate which is supported above the bottom wall of the container by any convenient means, such as a set of spaced-apart rocks. Gravel is placed over the bag and the plate to conceal it from view and a suction tube draws water from under the plate by means of a pump placed within a sump box attached to the top edge of the container. In use, a bacteria culture is established and maintained in the bed formed by the mixture of natural ingredients so that the bacteria culture cleans the water in the container. The overflow lip serves to aerate the water by flowing it through air in a water fall effect. The aerated recirculated water flows through the natural ingredients to facilitate the proliferation of the bacteria. (Sinha-OEIS)
W79-04460

ELECTROLYTIC CELL FOR TREATMENT OF WATER,
Firma Hans Einhell G.m.b.H. Industriegelande, Landau (Germany, F.R.). (Assignee).
J. Miller, and F. Stummer.
U.S. Patent No. 4,121,991, 8 p, 4 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1512, October 24, 1978.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Electrolysis, Electrodialysis, Electrodes, Ions, Hardness(Water).

An electrolytic cell is described for the treatment, particularly the purification and sterilization of water, which comprises a closed container with a lower inlet opening and an upper outlet opening for the water and electrodes which are adapted to be connected with the positive pole and the negative pole of a DC source. In the interior of the electrolytic cell free movable particles are located whose density is higher than that of the water to be treated and which are prevented from leaving the electrolytic cell by suitable means adjacent to the inlet and the outlet. The movable particles, by their agitation, continuously scratch off any deposits formed on the surfaces of the electrodes. One embodiment of the invention effects electrodialysis by using an electrodialysis diaphragm surrounding the anode, forming a closed anode compartment, where water flows at a very slow rate compared with the main flow or not at all and where the negative ions are concentrated. (Sinha-OEIS)
W79-04469

5G. Water Quality Control

RECREATION BENEFITS OF WATER QUALITY: ROCKY MOUNTAIN NATIONAL PARK, SOUTH PLATTE RIVER BASIN, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W79-04004

THE ADDITIVE AND INTERACTIVE EFFECTS OF POWERLESSNESS AND ANOMIE IN PREDICTING OPPOSITION TO POLLUTION CONTROL,
Illinois Univ. at Urbana-Champaign.
R. H. Orr.
Rural Sociology, Vol. 39, No. 4, Winter 1974, p 471-486. 4 tab, 23 ref. OWRT B-052-ILL(3). 14-31-0001-3275.

Descriptors: Water pollution control, Waste water disposal, Social aspects, Political aspects, Psychological aspects, *Attitudes, *Illinois, Anomie.

The additive and interactive effects of different aspects of alienation on attitudes toward pollution control were determined for residents of an Illinois community which was concerned with a sewage treatment issue. A sample of 213 community residents of voting age was obtained and questionnaires were administered during May, 1971. Powerlessness and anomie, while not additive, acted interactively to explain opposition to pollution control. Furthermore, this relationship was characterized by a 'saturation' or diminishing return effect. Alienation produced negativism toward the issue up to a certain point, with a subsequent increase serving to lessen the issue opposition. The interaction effect was found to exist controlling for respondent socioeconomic and demographic characteristics.
W79-04010

TRANSIENT TEMPERATURE EFFECTS ON BOD AND DO CONCENTRATIONS ALONG A STREAM,
Kansas State Univ., Manhatten. Dept. of Chemical Engineering.
S. H. Lin, L. T. Fan, and L. E. Erickson.
Water Research. Vol. 7, p 1861-1873, 1973. 11 fig, 14 ref. OWRT B-015-KAN(14), B-021-KAN(7), B-030-KAN(5).

Descriptors: *Thermal pollution, Oxygen sag, Dissolved oxygen, Biochemical oxygen demand, Stream dynamics, Model studies, Heated water.

A transient version of Dobbins' dispersion model is extended to include the effect of temperature on BOD and DO concentrations along a stream. Waste heat discharge from a power plant is considered as the main cause for the temperature change. Effects of the axial dispersion coefficient, stream velocity, initial BOD concentration and DO removal rate on BOD and DO concentration levels are examined parametrically.
W79-04087

SOUTH PLATTE RIVER BASIN ACCOMPLISHMENT PLAN.
Environment Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 246,

Price codes: A08 in paper copy, A01 in microfiche.
December 4, 1972, 174 p.

Descriptors: *Water quality standards, *Regional planning, *Water quality data, *Water pollution, *Water quality, *Water pollution abatement, *South Platte River Basin, *Denver(CO), Biochemical oxygen demand, Coliform bacteria, Dissolved oxygen, Total suspended solids, Waste water disposal, Waste treatment, Industrial wastes, Sewerage, Sewage treatment, Colorado, Nebraska, Waste treatment facilities, Point source pollution, Government policies.

This Accomplishment Plan applies to the headwaters of the South Platte River Basin near the Colorado/Nebraska border, covering 350 main stem stream miles plus 469 tributary stream miles. The Basin encompasses Denver and surrounding counties, containing the largest metropolitan area in Region VIII. Municipal discharges and wastes from sugar beet processing plants and other industrial operations are the major waste sources. Present Colorado wastewater treatment plant standards are not adequate to meet ambient stream standards in most areas. The report discusses pollutant loadings, water quality standards, and tactical solutions to pollution problems so that water quality in the Basin would meet proposed standards by July 1, 1976. Tables of basin load summaries are presented listing fifth day BOD and coliform levels, proposed decreases of these levels over FY's 73-76, water quality objectives, and the year in which the minimum acceptable water quality levels are to be achieved. A chronological ordering of planned accomplishments is shown outlining specific actions EPA officials should take to insure adequate water quality in the region. Principal point source loads and locations are listed along with the type and amount of pollutant each source discharges. Tactical solutions are offered based on particular situations and problems with a timetable and manpower schedule for instituting the proposed solutions. The report ends by listing each discharger and the schedule for pollution reduction levels required by each to meet ambient water quality standards by July FY '76. (Coan-NC)
W79-04145

EFFECT OF SALINITY ON AGRICULTURE IN IRAQ,
Mosul Univ. (Iraq). Coll. of Engineering.
For primary bibliographic entry see Field 3F.
W79-04173

WATER QUALITY IMPROVEMENT IN SMALL PONDS,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
J. E. Garton, and R. E. Punnett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 147, Price codes: A02 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Inst., Oklahoma State Univ. Technical Completion Report, 1978. 10 p, 3 fig, 1 tab, 4 ref. OWRT A-065-OKLA(2), 14-34-0001-8038.

Descriptors: *Ponds, Hypolimnion, Pumps, Lake of the Arbuckles, Ham's Lake.

A simple method of determining destratifier design criteria was developed for water quality improvement in small ponds using a Garton pump. The method is based upon two major objectives: (1) to penetrate to the bottom of the pond with downward pumped surface waters; and (2) to pump a volume of water equal to the normal hypolimnion every two days. The data are presented in tabular form. From the table the advantage of using larger diameter pumps is apparent.
W79-04261

PROTOTYPE REAERATION MEASUREMENTS, BELTZVILLE DAM, PENNSYLVANIA,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
E. D. Hart.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York p 280-286, 1977. 4 fig, 2 ref.

Descriptors: *Reaeration, *Water quality, *On-site tests, *Pennsylvania, Reservoir releases, Withdrawal, On-site data collections, Measurement, Dissolved oxygen, Water temperature, Dams, *Beltzville Dam(PA).

Prototype water quality tests were conducted at Beltzville Dam during August 1976. The purposes of these tests were to determine the location and degree of reaeration of flow that occurs as it passes through the outlet works and to provide prototype data with which to evaluate the accuracy of the Army Engineer Waterways Experiment Station (WES) selective withdrawal computer model, SELECT. Twelve tests were conducted. Temperture and dissolved oxygen data (vertical profiles) were collected upstream of the dam, at seven stations within the outlet structure, and at one station in the downstream channel. The tests involved various flow rates and intake levels. The results of these prototype tests showed: (1) the dissolved oxygen content of the release flows was approximately 90 to 95% of the saturation level regardless of the dissolved oxygen content of the flow entering the structure or the discharge, and major reaeration occurred within the outlet structure downstream of the water-quality gate; and (2) the predictions of the SELECT model were in close agreement with the observed data. (See also W79-04351)(Humphreys-ISWS)
W79-04380

AMERICAN DREDGING COMPANY V. STATE DEPARTMENT OF ENVIRONMENTAL PROTECTION (ORDER BANNING DUMPING OF DREDGE SOIL IN PROTECTED WETLANDS AREA UPHELD),
161 N.J. Super. 504, 391 A.2d 1265-71 (1978).

Descriptors: *Wetlands, *Dredging, *Eminent domain, *New Jersey, Regulation, Public benefits, Land use, Land classification, Property values, Coastal engineering, Environmental control, Legislation.

Plaintiff, a New Jersey dredging company, sought to overturn an order of the New Jersey Department of Environmental Protection (DEP), which prohibited the company from placing dredged materials on certain lands the company owned. Plaintiffs contended the order was void in that it constituted a taking of property without the payment of just compensation. The DEP's order was issued pursuant to a state statute designed to protect and preserve coastal wetlands. The statute designated 159 acreas of the plaintiff's land as wetlands and made them subject to the DEP's regulatory authority. On appeal, the court held that the order prohibiting deposits of dredge soil was not unreasonable and did not constitute a taking of the plaintiff's land without compensation. The court stated that the DEP restriction was a valid exercise of the state's police power. The restriction while resulting in a diminution in the land's economic value, did not require compensation. The order promoted a substantial public purpose, namely the protection of wetlands. The reasonableness of such restrictions requires a case-by-case determination. (Hucks-Florida)
W79-04415

SECTION 404 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977: HYDROLOGIC MODIFICATION, WETLANDS PROTECTION AND THE PHYSICAL INTEGRITY OF THE NATION'S WATERS,
For primary bibliographic entry see Field 5A.
W79-04419

IDAHO'S ENVIRONMENT (PROBLEM OF UNFETTERED EXPLOITATION RIGHTS V. ENVIRONMENTAL CONCERN),
For primary bibliographic entry see Field 5D.
W79-04421

EPA PROPOSED FAR-REACHING REGULATIONS FOR REDUCING SYNTHETIC ORGANICS IN DRINKING WATER.
For primary bibliographic entry see Field 5F.
W79-04422

LIABILITY FOR OIL POLLUTION UNDER THE MERCHANT SHIPPING (OIL POLLUTION) ACT 1971,
Aberdeen Univ. (Scotland).
For primary bibliographic entry see Field 6E.
W79-04425

WISCONSIN'S ENVIRONMENTAL DECADE, INC. V. DEPARTMENT OF NATURAL RESOURCES (CITY POLICY COULD NOT PREVENT CHEMICAL TREATMENT OF STATE WATERS),
For primary bibliographic entry see Field 2H.
W79-04428

CITIZENS' COMMITTEE TO PRESERVE LAKE LOGAN V. WILLIAMS (STATE AGENCY'S MAINTENANCE OF WATER QUALITY THROUGH CONTROL OF EFFLUENTS FOUND TOO STRICT),
For primary bibliographic entry see Field 5D.
W79-04430

CORPORATE COMPLIANCE AND COMPENSATION PROBLEMS IN ENVIRONMENTAL PROTECTION: IMPLICATIONS OF UNITED STATES V. RESERVE MINING COMPANY,
J. H. Tucker.
Natural Resources Lawyer, Vol. 10, No. 3, p 555-90, 1977.

Descriptors: *Pollution abatement, *Great lakes, *Industrial wastes, *Cost analysis, Regulation, Water pollution, Environmental control, Public health, Legislaton, Mineral industry, Water quality, Judicial decisions.

The costs and impact of pollution across the country have reached staggering proportions. Both federal and state governments have made extensive commitments to the reduction of pollution and the maintenance of a clean environment. A crucial consideration in the effort to abate pollution is that of cost. Determination of who will bear the costs of cleaning up the environment and how the money will be spent is necessary before any effective program can begin. Various solutions to the problem of financing pollution control are identified and discussed. Reserve Mining Co. v. Environmental Protection Agency, a recent federal case involving the finance issue and arising in Minnesota, is discussed. The case offers a textbook example of the various and often conflicting social, economic and political considerations which face a court dealing with industrial pollution. The history and legal impact of the Reserve decision is also discussed. In addition, suggestions are made for achieving corporate compliance with pollution regulations, apportioning costs throughout society and compensating those persons damaged by pollution. New approaches are need to ensure corporate compliance with environmental control measures. (Hucks-Florida)
W79-04431

COMMONWEALTH DEPARTMENT OF ENVIRONMENTAL RESOURCES V. CITY OF LEBANON (COMPULSORY FLUORIDATION HELD TO BE A FURTHERANCE OF PUBLIC HEALTH).
393 A. 2d 381-86 (Pa. 1978).

Descriptors: *Flouirdation, *Public health, *Administrative decisions, *Pennsylvania, Water qual-

ty, Permits, Water supply, Regulation, Administrative agencies, Chemicals, Water treatment, Cities.

Plaintiff city, which began to floruidate its water upply in 1972, sought permission of the Pennsylvania Department of Environmental Resources DER) to cease such flouridation. The request was lenied, and the city appealed, contending the DER had abused its discretion by refusing the ity's request for discontinuation of the flouridaion as a condition to receiving a water permit. The Pennsylvania Supreme Court held that the DER had the power--for protection of public ealth--to prohibit the alteration of the chemical omposition of the water by the city without DER pproval. The evidence supported by DER conlusion that flouridation of domestic water supplies vas an important means of preventing tooth decay, specially in children, and thereby protecting the ublic health. Assuming that the DER had the uthority to require applicants to undertake flouriation as a condition to obtaining a water supply ermit, the fact that the DER did not enforce such requirement did not render defective its refusal to anction the proposed abandonment of flouridation y a permit holder. (Hucks-Florida)
V79-04433

. I. DUPONT DE NEMOURS & CO. V. TRAIN EPA AUTHORITY TO SET INDUSTRY WIDE FFLUENT LIMITATIONS BY REGULATION,
or primary bibliographic entry see Field 6E.
V79-04439

OPE V. CITY OF ATLANTA (ACT REGULATNG CONSTRUCTION IN RIVER FLOOD LAIN HELD NOT TO BE UNCONSTITUIONAL TAKING OF PROPERTY WITHOUT OMPENSATION).
or primary bibliographic entry see Field 6E.
/79-04452

EDERAL WATER POLLUTION CONTROL CT AMENDMENTS OF 1977 (SEATTLE, /ASH.).
or primary bibliographic entry see Field 6E.
/79-04457

IL-WATER SEPARATOR,
allast-Nedam Groep, N. V., Amstelveen (Nethernds).
. G. Middelbeek.
.S. Patent No. 4,123,365, 4 p, 2 fig, 18 ref; Official azette of the United States Patent Office, Vol 5, No 5, p 1977, October 31, 1978.

escriptors: *Patents, *Oil pollution, *Water poltion treatment, Separation techniques, Water ality control, Equipment, Gravity separation.

separator is described for two liquids, in which e heavy liquid is separated from the light liquid ch as oil and all light liquid is discharged rough the inlet chamber and all heavier liquid is ansmitted further via a drain provided underath the separator. The device includes a tank ving opposing end walls spaced from each other d a separator, comprising two parallel inclined ates spaced from each other, in the tank. The parating device also includes an inlet in one end all of the tank for the liquid to be purified, a first tlet in the other end wall of the tank for the rified liquid, and an overflow between the first tlet and the separator. The one end wall of the nk and the one of the two parallel plates closest the one end wall are spaced throughout their tend from each other and define a space between em to substantially eliminate turbulence of the uid before entering the separator. The separating vice also includes a second outlet for substances be separated that are lighter than the purified uid. The second outlet is in the upper end of the e end wall of the tank above the inlet. (Sinha-EIS)
79-04461

ELECTROLYTIC CELL FOR TREATMENT OF WATER,
Firma Hans Einhell G.m.b.H. Industriegelande, Landau (Germany, F.R.). (Assignee).
For primary bibliographic entry see Field 5F.
W79-04469

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

OBTAINING SPECIFICATIONS FOR MINIMUM COST IRRIGATION SYSTEMS,

Idaho Univ., Moscow. Dept. of Agricultural Engineering.
J. R. Busch.
In: Proceedings of the ASCE Irrigation and Drainage Division Specialty Conference, Logan, Utah, August 13-15, 1975, p 456-475. 12 fig, 2 tab, 12 ref, 1 append. OWRT B-028-IDA(3) and B-033-IDA(4).

Descriptors: *Irrigation, *Distribution systems, *Cost analysis, *North Rigby Irrigation District, Jefferson County, Idaho, Model studies, Irrigation programs, Capital costs, Operating costs, Annual costs, Pipelines, Irrigation design, Irrigation efficiency, Irrigation engineering, Channeling, Pumping, Water management(Applied), Sprinkler irrigation, Cost comparison.

A procedure for selecting and arranging irrigation system components, in compliance with all constraints, at a minimum cost is presented. The North Rigby Irrigation District in Jefferson County, Idaho, was used as a test area for developing the methodology, where several alternative application and distribution system components were considered in addition to the existing system. Improved gravity, hand-line, and side-roll sprinkler systems were added to the unimproved gravity system. Alternative distribution systems considered included the existing unlined channel system, lined channel, gravity pipeline, high pressure pipeline, and wells with low and high head pumps. Lined and unlined channels and gravity pipeline were considered to be compatible gravity components. Annual costs obtained and projected for the present and proposed systems included capital costs, labor costs, machine hire, and management and operation costs. The results of this model formulation indicate which types of system components would best meet a given set of conditions. (Davison-IPA)
W79-04012

CONVECTIVE CONTAMINANT TRANSPORT TO PUMPING WELL,

Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W79-04022

FLOOD FREQUENCY OF SMALL STREAMS IN ALABAMA,

Geological Survey, University, AL. Water Resources Div.
D. A. Olin, and R. H. Bingham.
Alabama Highway Department HPR No. 83, August 1977. 44 p, 12 fig, 1 tab, 10 ref.

Descriptors: *Flood forecasting, *Flood frequency, *Flood recurrence interval, *Alabama, *Small watersheds, Analytical techniques, Regression analysis, Equations, Estimating, Streamflow, Peak discharge, Channel morphology, Geomorphology, Drainage area.

Equations have been developed for estimating future floods for 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals on natural streams in Alabama with drainage areas of 1 to 15 square miles. One equation for each recurrence interval applies statewide. The equations were developed by multiple regression analysis of flood magnitudes obtained from both observed peak discharges and synthetic discharge data generated with a calibrated rainfall-runoff model, and physical basin characteristics. The regression analysis indicated that drainage area and main channel slope are the most significant basin characteristics affecting flood frequency and magnitude. Those characteristics can generally be determined from topographic maps. (Woodard-USGS)
W79-04024

HYDROLOGIC DATA FOR SOLDIER CREEK BASIN, KANSAS,

Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-04026

A MATHEMATICAL MODEL OF MONTHLY FLOW SEQUENCES,

Technical Univ. of Istanbul (Turkey).
For primary bibliographic entry see Field 2E.
W79-04054

COMPUTER PROGRAMS IN WATER RESOURCES,

Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 7C.
W79-04081

PLANNING FOR PROPER USE OF LAND AND WATER.

Oregon State Univ., Corvallis. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 888, Price codes: A05 in paper copy, A01 in microfiche. July 1977. Spring Quarter Seminar Series, 1977. 92 p, 6 fig, 31 ref. OWRT-A-999-ORE(20).

Descriptors: *Water resource development, *Water management(Applied), *Oregon, *Planning, Regional development, Urbanization, Columbia River, State government, Local government, Interstate commissions, Water allocation, Watershed management, Legal aspects, Pacific Northwest.

A compilation of papers from a weekly series examining some aspects of land and water planning in Oregon is presented. The Water Resources Research Institute, on the campus of Oregon State University, serves the state by fostering, encouraging, and facilitating water research; it administers and coordinates statewide and regional programs of multidisciplinary research in water and related land resources. Topics covered are: planning of water and land use in the Pacific Northwest; Oregon planning in the nonpoint source areas of forestry, agriculture, septic tanks, and water resources; comprehensive planning in a small Oregon community; the role of regional government in planning; planning and the allocation of water resources; management of the Columbia River; flood plain management; urbanization and water resources planning; and the controversy surrounding the Bull Run Watershed. (Davison-IPA).
W79-04113

HYDROLOGIC AND WATER QUALITY MODELING OF SURFACE WATER DISCHARGES FROM MINING OPERATIONS,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
E. E. Herricks, V. O. Shanholtz, and D. N. Contractor.
Virginia Polytechnic Institute and State University, Department of Agricultural Engineering, Research Division Report No. 159, January 1975. 44 p, 7 fig, 9 tab.

Descriptors: *Mine drainage, *Hydrologic models, *Sediment transport, Analytical techniques, Mathematical studies, Overland flow, Channel flow, Galerkin's techniques.

A parametric, lumped system model was successfully used to generate continuous streamflow sequences for areas having no historical record. These data provided a synthetic record for evaluating a steady state conservative SO4 model. Simulated SO4 concentrations, which give an indiction of both amount and intensity of acid mine drainage, showed acceptable agreement with actual concentrations. The cleansing action of a given storm system was predicted by sediment transport theory and hydrologic models. A table delineating the maximum size of sediment that could be moved as a function of stage is presented. The application of finite element methods, using Galerkin's technique, was successfully used to solve the one-dimensional unsteady partial differential equations of continuity and momentum (with kinematic wave approximation) for overland and channel flow. The effect of geometric alterations typical of surface mining is illustrated.
W79-04134

PLANNING FOR WATER RESOURCES,
Thames Water Authority, London (England).
For primary bibliographic entry see Field 6D.
W79-04152

A METHOD FOR PARAMETER SENSITIVITY ANALYSIS IN DIFFERENTIAL EQUATION MODELS,
Albany Medical Coll., NY. Div. of Computer Science.
R. C. Kohberger, D. Scavia, and J. W. Wilkinson.
Water Resources Research, Vol. 14, P 25-29, February, 1978. 4 fig, 4 tab, 13 ref.

Descriptors: *Mathematical models, Least squares method, *Analytical techniques, Probability.

A numeric method for analyzing global parameter sensitivity about a fixed point in parmeter space for differential equation models is presented. The method is suitable for large-scale, multiresponse systems which may not be in steady state. By using a quadratic model, the relationship between several global response characteristics and parameter perturbations is examined. Sensitivity relaionships are defined with both backward elimination regression model selection procedures and eigenvalue-eignenvector analyses. An example of the method is given using an ecosystem model consisting of 14 coupled differential equations. (Skogerboe-Colorado State)
W79-04229

ON OSCILLATION OF NUMERICAL SOLUTION OF A MODIFIED RICHARDS' EQUATION,
Utah International Inc., San Francisco, CA. Dept. of Environmental Quality.
For primary bibliographic entry see Field 2G.
W79-04231

TOPOLOGICAL CLASSIFICATIONS OF DRAINAGE NETWORKS: AN EVALUATION,
Indiana Univ., Bloomington. Dept. of Geography.
For primary bibliographic entry see Field 2A.
W79-04232

DRAIN-HOLE DRILLING CAN INCREASE PRODUCTIVITY,
EG and G Idaho, Inc., Idaho Falls.
For primary bibliographic entry see Field 8A.
W79-04249

TECHNOLOGY AND DESERTIFICATION,
Escuela Nacional de Agricultura, Chapingo (Mexico)
M. Anaya-Garduno.
Economic Geography, Vol. 53, No. 4, p 407-412, Oct. 1977. 36 ref.

Descriptors: *Arid lands, *Technology, *Desertification, Planning, Water management(Applied), Comprehensive planning, Project planning, Water resources development, Regional development, Groundwater, Soil conservation, Farm management, Water supply, Irrigation systems, Soil erosion, Vegetation establishment, Biodegradation, Energy, Conservation.

In solving the major problems in arid regions and reversing the processes of desertification, modern technology has played both a constructive and destructive role. Numerous examples of destructive technology are evident in the mismanagement of irrigation water, over-exploitation of groundwater, deficient drainage systems, sedimentation and siltation, loss of fertile soil due to injudicious farming systems, reduction of vegetative protection of the soil and inadequate location of watering points. It is contended here that proper management systems combined with appropriate technological inputs offer the best prospects for successfully combatting deterioration in arid regions. Three principles should be taken into account when determining the appropriate technologies to employ in combatting desertification: (1) start anti-desertification action with the less deteriorated systems of production, (2) use intermediate technology wherever possible, and (3) consider traditional indigenously developed technologies before establishing new land use systems. Problems generated by the physical and biological degradation of land use systems are surveyed and appropriate technologies considered in this analysis under five categories: (1) scarcity of water (2) irrigation water mismanagement, (3) soil erosion, (4) reduction of vegetation cover and animal productivity, and (5) scarcity and misuse of energy. (Tickes-Arizona)
W79-04283

RESETTLEMENT AND DESERTIFICATION: THE WAGOGO OF DODOMA DISTRICT, TANZANIA,
Dar es Salaam Univ. (Tanzania).
A. C. Mascarenhas.
Economic Geography, Vol. 53, No. 4, p 376-380, Oct. 1977. 2 ref.

Descriptors: *Regional analysis, *Desertification, *Rural sociology, *Dry farming, *Social impact, *Resettlement, Water shortage, Regional economics, Social aspects, Resource allocation, Social adjustment, Local governments, Droughts, Arid lands, Flood damage, Tanzania.

The contrasting catastrophies of drought and flooding have beseiged arid Tanzania since its early years of independence. Dodoma, a region in central Tanzania is analyzed here to illustrate the effects of desertification upon the people and the consequences of resettlement. The sedentary but mobile Wagogo people have paradoxically subsisted upon cereals while maintaining a value system almost entirely oriented toward pastoralism and cattle raising. Although these people have periodically undergone great suffering imposed by the water shortages and environmental stresses of the desert, they have chosen to remain in Dodoma, and try to master the environment. Following the 1969 drought, however, the government began to implement a plan to resettle these people in planned villages. The experiences of one household are described here to illustrate that while the government resettlement program has had the highest and best motivations, real problems and difficulties have resulted. The adaptative potential of traditional livelihoods, the pace at which development can or should take place, and Tanzania's dependent position in the global economic system are the major variables effecting the development of this region. Documented here is the willingness of the pastoral people to move to concentrated village settlements and their equal unwillingness to abandon their traditional values. (Tickes-Arizona)
W79-04296

WATER CONTROL AND DESERTIFICATION, THE RESETTLED NOMADS OF DEH LURAN, IRAN,
Toronto Univ. (Ontario).
A. Whyte.
Economic Geography, Vol. 53, No. 4, p 372-375, Oct. 1977. 2 ref.

Descriptors: *Political constraints, *Economic impact, *Social impact, *Nomadism, Water resources development, Migration, Economic feasibility, Social aspects, Social needs, Rural sociology, History, Irrigation practices, Social adjustment, Transhumance, Pastures, Arid lands, Iran.

In the 40 years since the Iranian Government's resettlement policy was inaugurated the Zagros foothills village of Deh Luran may be considered representative of the continuing dilemmas faced when any such attempt at social reconstruction disrupts traditional life styles. While its present 1500 inhabitants struggle with a subsistence agriculture, made more uncertain by serious desertification, they see their nomadic relations still using the village as a stopping point in their continued migratory life. Archaeological records, however, reveal a dynamic equilibrium established in ancient times between increasing ecological aridity and increasing human control of water resources through irrigation systems based on sophisticated water works. In modern time, however, the sudden imposition of settlement life without the wealth and organization to invest in high technology has created an imbalance which will require an accommodation permitting a mixed strategy of transhumance between two permanently located villages where advantages of herding could be combined with a stable agriculture and settlement infrastructure. (Tickes-Arizona)
W79-04306

DIGITAL SIMULATION AND PREDICTION OF WATER LEVELS IN THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
F. K. Mack, and R. J. Mandle.
Maryland Geological Survey Report of Investigations No. 28, 1977. 42 p, 25 fig, 7 tab, 41 ref.

Descriptors: *Model studies, *Groundwater availability, *Maryland, *Coastal plains, *Aquifer characteristics, Confined water, Analytical techniques, Mathematical models, Regression analysis, Forecasting, Water supply, Water demand, Water yield, Groundwater recharge, *Anne Arundel County, *Prince Georges County, *Charles County, *Calvert County.

A digital model of the Magothy aquifer, an important source of water for the Coastal Plain of Maryland, was developed to provide county planners in southern Maryland with information on the availability of water from this source. The digital model is based on a U.S. Geological Survey computer program which employs the iterative alternating-direction implicit procedure (IADIP) to solve finite-difference approximations of the groundwater flow equations in two dimensions. The model was calibrated by adjusting hydrologic parameters until computed drawdowns matched historic drawdowns measured in several observation wells. Great differences exist in the amount of water available from one part of the project area to another because of the variability of the transmissivity of the aquifer and the amount of available drawdown. A series of tests that stressed the model by pumping from hypothetical wells located in the best hydrogeologic parts of each county, using projected water demands of the year 2000, indicated adequate supplies would be available from the Magothy in southern Anne Arundel County and northern Calvert County, but not in Charles or Prince Georges Counties. (Woodard-USGS)
W79-04399

OPTIMIZATION TECHNIQUES APPLIED TO GROUND-WATER DEVELOPMENT,
Geological Survey, Reston, VA. Water Resources Div.
S. P. Larson, T. Maddock, III, and S. S. Papadopulos.
In: Proceedings of Symposium on the Optimal Development and Management of Groundwater, Birmingham, England, July 1977: International Association of Hydrogeology, p E57-E66, 1977. 3 fig, 6 ref.

escriptors: *Groundwater, *Safe yield, *Optimiz-on, *Computer models, Water wells, Draw-wn, Aquifers, Mathematical models, Water nagement(Applied), *Nonlinear systems, *Non-ear programming.

management model was used to determine the fe yield' of an unconfined aquifer near Carmel, diana. To develop the management model a asi-linearized digital aquifer model was com-ied with a nonlinear optimization program. Re-onse functions determined from the aquifer odel provided a basis for optimization subject to set of constraints. Potential well sites were re-icted to areas of high transmissivity and a mini-im discharge of 0.8 cubic foot per second (0.02 bic meter per second) was required from poten-l wells. Drawdowns throughout the potential ell-site areas were restricted to half the initial urated thickness. The results demonstrate that nagement models provide a useful formal proce-re for determining the safe yield of aquifers der a given set of constraints. (Woodard-USGS) 79-04406

IE LEGAL SIGNIFICANCE OF THE LOCAL OVERNMENT COMPREHENSIVE PLAN,
r primary bibliographic entry see Field 6E.
79-04420

OASTAL COMMUNITIES - PARTNERS OR PPETS IN OUTER CONTINENTAL SHELF EVELOPMENT,
laware Univ., Newark. Coll. of Urban Affairs l Public Policy; and Delaware Univ., Newark. ll. of Marine Studies.
r primary bibliographic entry see Field 6E.
79-04426

OTES ON CALIFORNIA'S COASTAL GOV-NANCE: A REPLY TO PETER DOUGLAS,
ifornia Univ., Berkeley. Inst. of Governmental dies.
Scott.
astal Zone Management Journal, Vol. 4, No. 4, 75-85, 1978.

scriptors: *California, *Local government, oasts, *Comprehensive planning, Legislation, te government, Regulation, Permits, Regions, ograms, Shores.

recent years California has instituted several grams aimed at effectively governing and regu-ng coastal areas. In 1972, Proposition 20 set up tate coastal commission and provided for six ional commissions to assist in coastal planning vities. In 1976, Proposition 20 was replaced by ew California coastal law. The new law pro-es for the eventual termination of the regional mmissions. The coastal planning process which previously a part of the duties of the regional mmissions will be shifted downward to local ernment by making the cities and counties prin-l participants in a state-regional-local collabo-ve planning process. Under the 1976 law, local ernments are preparing their own local coastal grams. These local programs are subject to e approval. Some debate has ensued as to ether the regional commissions should be re-ed as an intermediate part of the state-local aborative plan. The various arguments for and inst maintaining the three-tier state-regional-l program of coastal regulation are analyzed discussed. (Hucks-Florida)
9-04444

DERAL LANDS AND CONSISTENCY: AN TERGOVERNMENTAL PLANNING PRO-SAL FOR THE COASTAL ZONE,
I. Williamson.
stal Zone Management Journal, Vol. 4, No. 4, 5-55, 1978. 2 fig.

criptors: *Federal-state water rights conflicts, source development, *Coasts, *Comprehensive ning, Federal government, Federal jurisdic-tion, State government, State jurisdiction, Plan-ning, Washington, Legislation, Management.

In order to preserve, protect, develop and enhance the resources of the nation's coastal zone, the federal Coastal Zone Management Act of 1972 (CZMA) was enacted as a federally funded, water related program designed to assist participating states in meeting increasing and competing de-mands being made on the coastal zone. In defining the scope of state coastal zone management pro-grams permitted under the CZMA, federal-state conflict has arisen over the exclusion of federal lands from the coastal zone and the extent that state regulatory authority may be exercised over federal actions that have an impact on the coastal zone. In order to alleviate this conflict and pro-mote the Congressional goal of unified and consist-ent federal-state policies regarding public and pri-vate use of coastal resources, this article proposes an inter-governmental planning mechanism. This mechanism would incorporate the 'consistency re-quirements of the CMZA with federal ownership, use and regulation of coastal zones.' This approach is viewed as the best method of eliminating the long-standing struggle between the federal govern-ment and the states over jurisdiction and control of coastal resources. (Hucks-Florida)
W79-04446

ACCESS TO THE NATION'S BEACHES: LEGAL AND PLANNING PERSPECTIVES,
National Oceanic and Atmospheric Administra-tion, Washington, DC. Office of Sea Grant.
D. Brower.
Sea Grant Publications UNC-SG-77-18. Available from UNC Sea Grant, 105 1911 Building, North Carolina State University, Raleigh, North Carolina, 143 p, February, 1978. 2 app.

Descriptors: *Beaches, *Public rights, *Public access, *Planning, Access routes, Recreation facili-ties, Easements, Oceans, Prescriptive rights, Emi-nent domain, Coasts, Shores.

Insufficient public access to the nation's coastal beaches has long been recognized as a problem worthy of examination. At the same time, as recre-ational needs are increasing seashore resources are dwindling. Seashores, especially those with sandy beaches, are a unique natural resource with unusu-ally high recreational qualities. Two methods of making beaches available for public use are dis-cussed herein. The first is the creation of a public right to use the beach on at least a part of it. Another method would be to place portions of the shore in public ownership. Both states and the Federal government have instituted programs aimed at the problems of ownership and access. Several states have enacted 'Open Beaches' stat-utes which declare certain portions of the shoreline as being in the public domain. These statutes are examined along with measures such as the public trust doctrine, implied dedication, customary rights and prescriptive easements. There is an emphasis of legal tools available for preserving, perfecting and acquiring beach access. Finally various federal programs related to beach access are discussed. (Hucks-Florida)
W79-04448

POPE V. CITY OF ATLANTA (ACT REGULAT-ING CONSTRUCTION IN RIVER FLOOD PLAIN HELD NOT TO BE UNCONSTITU-TIONAL TAKING OF PROPERTY WITHOUT COMPENSATION).
For primary bibliographic entry see Field 6E.
W79-04452

TESTING SOCIAL INDICATORS IN THE TECHCOM MODEL FOR WATER DEVELOP-MENT,
Utah State Univ., Logan. Inst. for Social Science Research on Natural Resources.
W. H. Andrews, G. E. Madsen, and C. W. Hardin.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 281, Price codes: A10 in paper copy, A01 in microfiche. ISSR Research Monograph No. 8, January 1979, 187 p, 8 fig, 21 tab. OWRT C-7106(No 6210)(1), 14-34-0001-6210.

Descriptors: Evaluation, *Water resources plan-ning, *Model studies, Social aspects, Multiple pur-pose projects.

The major objectives were to relate four of the major goals of the Techcom model to comparable elements identifiable in an actual ongoing water development project as well as to relate the goals to other studies of social indicators. The four goals are Cultural and Community Opportunity, Aes-thetic Opportunity, Recreational Opportunity, and Collective Security. During the research several issues and problems are identified which point up inadequacies, not only with Techcom but with many other assessment approaches. Techcom was especially found to lack inputs from sociological and psychological perspectives and this research led to suggested changes in the definition of con-cepts and types of measurement procedures which might help remedy this deficiency. The Techcom framework needs further testing, the development of improved social data methodology, and the inclusion of subjective data to bring it closer to real societal objectives. However, it is a beginning to a much needed new generation of planning and evaluation techniques.
W79-04491

6B. Evaluation Process

RECREATION BENEFITS OF WATER QUAL-ITY: ROCKY MOUNTAIN NATIONAL PARK, SOUTH PLATTE RIVER BASIN, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Eco-nomics.
R. G. Walsh, R. K. Ericson, J. R. McKean, and R. A. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 733, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Inst., and Tech., Report No. 12, May 1978. 140 p, 7 fig, 16 tab, 88 ref, 3 append. OWRT B-042-COLO(4), 14-31-0001-3065.

Descriptors: *Water quality, *Recreation, *Recre-ation demand, *Rocky Mountain National Park, *South Platte River Basin(Colorado), *National Parks, Economics, Cost-benefit analysis, Cost benefit ratio, Water pollution, Water pollution ef-fects.

A random sample of 141 households were inter-viewed in Rocky Mountain Natonal Park during the summer of 1973 as part of a study to develop and apply a procedure for measuring the relation-ship between water quality and nonresident recrea-tion benefits. Park visitors were requested to rank photographs of water quality according to the perceived amount of pollution contained in the water in each photograph, and then were ques-tioned about their willingness to pay for high qual-ity water for recreational purposes. The question were designed to measure consumer surplus bene-fits. Willingness to pay was measured in terms of a recreation entrance fee, the value of waterfront property, and travel time. Some of the results included: (1) park visitors were willing to pay more in recreation fees rather than have the water quality decreases; (2) visitors were willing to travel 0.9% more to avoid a change in water quality; (3) income was positively related to willingness to pay an entrance fee for improved water quality; and (4) income was negatively related to willingness to increase travel time; i.e., for every $1,000 increase in income, willingness to travel decreased by 10%. It is concluded that park visitors from industrially developed regions with a dense population would be willing to pay more for water quality in the park. Colorado residents reported that they would be willing to pay about the same rates as non-residents for water quality. (Davison-IPA)
W79-04004

THE ADDITIVE AND INTERACTIVE EFFECTS OF POWERLESSNESS AND ANOMIE IN PRE-

DICTING OPPOSITION TO POLLUTION CONTROL,
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 5G.
W79-04010

THE ECONOMIC IMPACT OF INCREASED FOREST AND FARMLAND BEAVER DAMAGE IN MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Wildlife and Fisheries.
For primary bibliographic entry see Field 2H.
W79-04074

THE EFFECTS OF INLAND NAVIGATION USER CHARGES ON BARGE TRANSPORTATION OF WHEAT,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W79-04075

CONJUNCTIVE GROUND AND SURFACE WATER ALLOCATIONS: THE ECONOMICS OF A QUASI-MARKET SOLUTION,
Colorado State Univ., Fort Collins. Dept. of Economics.
J. Daubert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 992, Price codes: A09 in paper copy, A01 in microfiche. MS Thesis, Fall 1978. 182 p, 22 fig, 15 tab, 79 ref. OWRT B-109-COLO(8), 14-31-0001-4067.

Descriptors: Groundwater, *Water allocation, Water management, Pumping, Surface water, Water policy, *Conjunctive use, South Platte River Basin.

This thesis compares the net farm benefits and corresponding ground and surface water allocation under an augmentation plan; an unrestricted pumping policy; a system which prevents pumping; and pumping quotas. Any change from the historical open access policy generates a gain to surface water right owners, a loss to those who must curtail their pumping, and an administrative cost. The goal is to determine the water resource policy that maximizes the net social benefits. A computer simulation model incorporating the legal, hydrologic and economic characteristics of the lower South Platte River Basin in Colorado evaluates the policies. In the legal submodel, surface water allocations must comply with the prior appropriation doctrine. The hydrologic submodel represents the physical interrelationships between a stream and aquifer. The economic submodels represent the intermediate and short-run farm decision making process. An intermediate model uses an expected income-variance model to determine the planted acreage of each crop. The short-run model allocates available surface and groundwater between crops according to a profit maximizing motive. The simulation combines all submodels to predict the net income for each alternative conjunctive water use policy. Comparing the simulation results of a policy which prohibits pumping and an open access policy indicates that groundwater withdrawals are responsible for much of the area net income. Unrestricted groundwater use increases the predicted net benefits from $11.3 to 33.1 million. However, during a year where river flows are below average pumping causes a significant depletable externality. Pumping, by reducing surface flows, reduces the income of farmers that use senior surface water rights by 39 percent. The most efficient simulated conjunctive use water policy is augmentation plans which generate the largest area net benefits, $36.4 million, and eliminate any loss to senior surface users.
W79-04078

UNCERTAINTY IN WATER RESOURCE PLANNING IN THE CONNECTICUT RIVER BASIN,
Massachusetts Univ., Amherst. Water Resources Research Center.
E. R. Kaynor.
Water Resources Bulletin, Vol. 14, No. 6, p 1304-1313, December 1978. 21 ref. OWRT C-7178(No 6215)(1), 14-34-0001-6215.

Descriptors: *Risks, *Planning, *Water resources planning, *Theoretical analysis, *Evaluation, *Flood control, *Interbasin transfers, *Diversion, *Navigation, *Connecticut River.

Four ways of dealing with uncertainty in the resource planning process have been prescribed: to reduce it, to ignore it, to avoid it, and to convert it to risk as chance of occurrence for calculation in planning. This paper analyzes examples of water resource planning in the Connecticut River Basin to confirm, reject, or modify these prescriptions. The examples of planning chosen for analysis are navigation, flood control, and interbasin diversion for water supply. These confirm the desirability of reducing uncertainty, offer some support for strategies to avoid it and to convert it to risk, but do not support the desirability of ignoring it. (Godfrey-Mass)
W79-04082

ECONOMIC ANALYSIS OF THE CONJUNCTIVE USE OF SURFACE WATER AND GROUND WATER OF DIFFERING PRICES AND QUALITIES: A COMING PROBLEM FOR ARIZONA AGRICULTURE,
Arizona Agricultural Experiment Station, Tucson.
M. A. Boster, and W. E. Martin.
Technical Bulletin 235, 1977. 36 p, 8 fig, 19 tab, 38 ref, 1 append. OWRT A-048-ARIZ(4).

Descriptors: *Water supply development, *Colorado River, *Water transfer, Computer models, Agriculture, Water requirements, Irrigation, Economics, Water costs, Water quality, Salinity, Groundwater, Surface waters.

An economic evaluation of the adjustment alternatives open to irrigated agriculture in the proposed service area of the Central Arizona Project (CAP) in Pinal County, Arizona, is reported. The CAP involves the construction of an aqueduct to transport water from Lake Hauasu on the Coloredo River into the Maricopa County-Phoenix area through Pinal County to Tucson. Colorado River water contains different dissolved-salt concentrations than the groundwater and the surface water currently being used. Some areas of Pinal County have low salinity ratios, while others have a high salinity ratio; the optimum CAP-local water mix for typical crops was determined through the use of linear programming models. Each model includes alternative crop production activities using various quantities and mixes of CAP water and local surface groundwater. The models were designed to maximize net farm returns. The basic conceptual issues involved are discussed, Pinal County is described in detail, and results of analyses of alternative management scenarios are presented. (Davison-IPA)
W79-04104

REPORT ON CIBOLA DIVISION (6) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact and Research.
G. W. Greey, A. Jaten, and G. W. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 120, Price codes: A07 in paper copy, A01 in microfiche. June 1978. 142 p, 1 fig, 91 tab, 3 append. 14-06-300-2532.

Descriptors: *Recreation, *Colorado River, *Cibola Division(6), *Surveys, On-site data collections, Fishing, Swimming, Water skiing, Boating, Camping, Recreational demand.

An inventory to determine visitor levels and participation patterns on the Cibola Division (6) of the Lower Colorado River was conducted January 1, 1975 through December 31, 1975. This section of the Lower Colorado River is located between the Old Adobe Ruin site and the California Riverside and Imperial County line, and covers a 23.7 mile length. Study and analyses with on-site observations were done at 17 sites, for a total of 1,018 observations. Over the survey period 64,035.50 recreational vehicles visited the area; the total number of visitors was 321,186.20 Camping and picnicking had the greatest number of participants, 170,657.20. Water based activities accounted for 37% of the total participation, with fishing (48,217), motor boating (32,238), and swimming and tubing (25,256.50) having the major portion of water related participation. Results of the data show that most of the use occurred at the intersection of Oxbow Lake and the river channel, and the Walters Camp site. Although some visitors were local residents, the major users of this division were non-residents: the highly mobile transients, and visitors from the California coastal area. (Davison-IPA)
W79-04105

REPORT ON IMPERIAL DIVISION (7) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact Research.
G. W. Greey, A. Jaten, and G. W. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 956, Price codes: A07 in paper copy, A01 in microfiche. July 1978. 132 p, 2 fig, 85 tab, 3 append. 14-06-300-2532.

Descriptors: *Recreation, *Colorado River, *Surveys, *Imperial Division(7), On-site data collections, Fishing, Swimming, Water skiing, Boating, Camping, Recreation demand.

An inventory to determine visitor levels and participation patterns on the Imperial Division (7) of the Lower Colorado River was conducted January 1, 1976, through December 31, 1976. This section of the Lower Colorado River is located between the Old Adobe Ruin site and the Imperial dam, and covers a 37.3 mile length. Study and analyses with on-site observations were done at 16 sites, where a minimum of six weekend and three weekday observations were made for four, three month periods. Over the survey period 46,414.000 recreational vehicles visited the area; the total projected number of visitors was 135,567.50. Camping (149,575.50) and picnicking (77,748.00) accounted for 92.8% of the total land based participation. Water related activities accounted for 52.6% of all visitor participation with motor boating (95,620.50), swimming (71592.50), fishing (54,831.50), and water skiing (28,743 50) having the major portion of water related participation. Results of the data show that participation is varied and is predictable in some areas. The majority of visitors to the area are local residents, transient visitors and southern California coastal residents varying percentages of each group were attracted to different areas. (Davison-IPA)
W79-04106

REPORT ON LAGUNA DIVISION (8) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact Research.
G. W. Greey, A. Jaten, and G. W. Cheatham.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-288 89 Price codes: A04 in paper copy, A01 in microfich 1978. 64 p, 1 fig, 31 tab, 3 append. 14-06-300-253

Descriptors: *Recreation, *Colorado Riv *Laguna division(8), *Surveys, On-site data colle tions, Fishing, Water utilization, Swimming, Na ral resources, Recreation demand, Camping.

An inventory to determine visitor levels and p ticipation patterns on the Laguna Division (8) the Lower Colorado River was conducted Janu 1 through December 31, 1976. This section of t Lower Colorado River is located between Impe al Dam and Laguna Dam, and covers a 5.4 m

gth. Study and analysis with on-site observa-
ns were done at five sites, where a minimum of
weekend and three weekday observations were
de for four, three month periods. Over the
vey year 68,614.50 recreational vehicles visited
area; the total projected number of visitors was
,140.10. Camping (127,140.10) and picnicking
,195.00) accounted for 97.9% of the total land
ed participation; water related activities, limited
fishing and swimming, had 43,680.30 partici-
ts. Results of the data indicate that the major
up visiting the area was transient in nature, in
t they migrate from one geographic area to
ther seasonally, with the majority present
ing the temperate months. (Davison-IPA)
9-04107

TERIM REPORT, SOUTH UMPQUA RIVER. ANSCRIPT OF PUBLIC MEETINGS.
ny Engineer District, Portland, OR.
ailable from the National Technical Information
vice, Springfield, VA 22161 as AD-A036 543,
ce codes: A99 in paper copy, A01 in microfiche.
view Report on Umpqua River and Tributaries,
ruary 1972, Transcripts of meetings held at
eburg, Oregon, 28 October 1971.

scriptors: *Planning, *Water resources develop-
nt, *Water resources planning, *Reservoirs,
atershed management, *Public participation,
npqua River(OR), *South Umpqua River(OR),
ys Creek(OR), *Public meetings, Oregon,
lic access, Multiple-purpose projects, Water
ply, Recreation, Flood control, Irrigation,
lic agencies, Citizens, News media, Businesses,
vate organizations.

s volume contains transcripts of public meet-
held in Roseburg, Oregon on 28 October 1971,
d in conjunction with a plan for the solution of
er resource problems in the area drained by the
th Umpqua River, in the Umpqua River Basin.
o meetings were involved, and each transcript
ords attendance, participants, transcripts of oral
ements and statements on written attendance
ds. Discussion centers around the construction
he Days Creek dam and development of the
age facility on Days Creek. The Army Corps
Engineers' District Engineer sets out the details
he proposed development, and discussion from
se in attendance follows. The final section is a
sentation of exhibits. Included in the exhibits
statements and letters from public agencies, and
ements and letters from individuals, businesses,
s media, and private organizations, both favor-
and opposing the Days Creek Dam and Reser-
Project. (Zayac-NC)
9-04142

MUDDY RIVER COMPREHENSIVE SIN STUDY, ILLINOIS, VOL. 7, APPENDIX AND N.
Muddy River Coordinating Committee, IL.
primary bibliographic entry see Field 6D.
9-04144

MPREHENSIVE BASIN STUDY: WHITE ER BASIN - ARKANSAS AND MISSOURI. L. 1, MAIN REPORT.
ite River Basin Coordinating Committee.
primary bibliographic entry see Field 6G.
9-04146

MPREHENSIVE BASIN STUDY: WHITE ER BASIN - ARKANSAS AND MISSOURI. L. VI: APPENDIX P - PLAN FORMULA-ON.
ite River Basin Coordinating Committee.
primary bibliographic entry see Field 6G.
9-04147

L REESTABLISHMENT: RETROSPEC-E COMMUNITY STUDY OF A RELO-TED NEW ENGLAND TOWN,
v Hampshire Univ., Durham. Water Resources
earch Center.
. Adler, and E. F. Jansen, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A058 220, Price codes: A11 in paper copy, A01 in microfiche. May 1978. 229 p, 11 appendices, 14 fig, 2 tab, 19 photos, IWR Contract Report 78-4. DACW 33-77-C-0077.

Descriptors: *Water resource management, *Economic impacts, *Social impacts, *Relocation, *Hill(NH), *Danbury(NH), Political impact, Regional planning, Sites, Property values, Methodology, Surveys, Flood control, Reservoirs, Attitudes, New England, Tax base, Social costs, Trend analysis, Attitudinal analysis, Impact assessment.

This study examines the relocation of Hill, NH in 1940 and determines the socioeconomic impact of the relocation on the town. Two flood control projects built by the Army Corps of Engineers necessitated relocation of the town. The study is divided into 6 section: (1) the town's background and history; (2) overall impacts of the relocation; (3) social impacts; (4) economic impacts; (5) political impacts; and (6) processes and techniques used in relocating Hill. The study includes a descriptive narrative which elucidates relevant indicators that represent the impacts upon the relocated families, the community as a whole, and the region. Social, political, and economic impacts were examined over 3 time periods--prelocation, relocation-construction, and post-relocation. Different methodologies are combined into three basic analyses to measure and describe different dimensions of the relocation: (a) an archival search; (b) a trend analysis; and (c) a questionnaire-attitudinal study of the existing community. A trend analysis of social and economic indicators showed that fluctuations in population, tax base, commercial enterprises, etc., paralleled that of other communities in the area. Decreases in indicators such as population were short term. Findings indicate that local involvement in the relocation process played an important role in the success of the project. Appendices list those contacted for information, financial aspects of the relocation, questionnaire findings, a chronology of events, articles describing the relocation process, minutes from public meetings, letters, and possible indicators for trend analysis. (Coan-NC)
W79-04158

WATER SYSTEMS COUNCIL: A VARIETY OF SERVICES TO PUMP MANUFACTURERS AND THE WATER WELL INDUSTRY,
For primary bibliographic entry see Field 4B.
W79-04240

HEAT PUMP UPDATE.
Water Well Journal, Vol 33, No 1, p 45, January 1979. p 45, 1 tab.

Descriptors: *Ground water, *Heat pumps, *Cost analysis, Air conditioning, Space heating, Water heating.

Energy usage with monthly and daily costs are listed for a ground water source heat pump being monitored by the National Water Well Association in central Ohio. The costs are for heating/cooling and hot water generation. During June through September, only the air conditioning mode was used. The average monthly cost was $27.77 or $.91 per day. Compared to an electric resistance water heating system the heat pump system uses 40% less energy while simultaneously providing air conditioning requirements. (Purdin-NWWA)
W79-04246

WATER WELLS HELP TEXAS CITY SAVE MONEY.
Water Well Journal, Vol. 33, No. 1, p 46, January 1979.

Descriptors: *Water resources development, *Water wells, *Suburban areas, Groundwater resources, Bond issues, Texas.

Irving, Texas will save $430,000 in water supply costs under a 10-year contract with Whalen Corp., a water resources technology firm. Four wells will be reworked, one at a time, to raise their capacity from 4.3 mgpd to 5.76 mgpd, or 19% of Irving's total maximum capacity. College Station is also under a contract with Whalen Corp. which supplies 30 to 40% of its water needs, at a rate 25% lower than a neighboring community. The contract requires that the city pay only for the water it uses. At the end of the contract period the wells will become the city's property for a small fee. This type of contract offers an alternative method to using valuable bond money for municipal improvements and avoids years of delay involved in obtaining bond funds. (Purdin-NWWA)
W79-04247

PERSPECTIVES ON DESERTIFICATION,
New South Wales Univ., Kensington (Australia).
For primary bibliographic entry see Field 3F.
W79-04282

TECHNOLOGY, REGIONAL INTERDEPENDENCE, AND POPULATION GROWTH, TUCSON, ARIZONA,
Arizona Univ., Tucson.
A. W. Wilson.
Economic Geography, Vol. 53, No. 4, p 388-392, Oct. 1977. 7 ref.

Descriptors: *Community development, *Arizona, *Groundwater availability, *Regional analysis, *Regional development, Human population, Ecology, Environmental effects, Social aspects, City planning, Urban sociology, Arid lands, Regional economics, Water supply, Resource allocation, Social aspects.

Desertification presents a unique problem in the Sonoran Desert of Arizona for here aridity is an attractive asset to most of its inhabitants. The human development of the Sonoran Desert is typified by the city of Tucson and its special attributes which include: (1) a close connection with the rest of the U.S., (2) a unique natural environment in which to live or visit, (3) avoidance of food production problems, and (4) an increasing insulation in this highly technological society from other burdens of an occasionally harsh environment. The focus of this analysis: how to define desertification when aridity is an asset rather than a liability, is a discussion of Tucson's groundwater problems, population growth, environmental consciousness, and livelihood patterns. How to make the best use of the most important limiting resource, water, has been the major consideration as this artificial, humanized environment has been imposed upon the natural desert ecology. It is argued, however, that the economic growth of the Tucson Basin has demonstrated that wise application of technology not only can triumph over the limited productive potential of an arid area but also can counteract or avoid any degradation in the region's natural ecology. (Tickes-Arizona)
W79-04307

NATIONAL FORESTS DO NOT HAVE RESERVED WATER RIGHTS FOR RECREATIONAL PURPOSES,
For primary bibliographic entry see Field 6E.
W79-04417

A NONLINEAR PROGRAMMING ALGORITHM FOR REAL-TIME HOURLY RESERVOIR OPERATIONS,
California Univ., Los Angeles. Dept. of Engineering Systems.
W. S. Chu, and W. W-G. Yeh.
Water Resources Bulletin, Vol. 14, No. 5, p 1048-1063, October 1978. 2 fig, 3 tab, OWRT C-7099(No 6209)(2), 14-34-0001-6209.

Descriptors: *Optimization, Operations Research, *Computer programming, Multiple purpose projects, *Reservoir operations, *Hydroelectric power, Mathematical studies, Model studies.

The optimization of real-time operations for a single reservoir system is studied. The objective is to maximize the sum of hourly power generation

over a period of one day subject to constraints of hourly power schedules, daily flow requirement for water supply and other purposes, and the limitations of the facilities. The problem has a nonlinear concave objective function with nonlinear concave and linear constraints. Nonlinear Duality Theorems and Lagrangian Procedures are applied to solve the problem where the minimization of the Lagrangian is carried out by a modified gradient projection technique along with an optimal step-size determination routine. The dimensions of the problem in terms of the number of variables and constrainsts is reduced by eliminating the 24 continuity equations with a special implicit routine. A numerical example is presented using data provided by the Bureau of Reclamation, Sacramento, California. (Snyder-Calif Davis)
W79-04482

PERCEPTIONS OF EFFECTIVE PUBLIC PARTICIPATION IN WATER RESOURCES DECISION MAKING AND THEIR RELATIONSHIP TO LEVELS OF PARTICIPATION,
Purdue Univ., Lafayette, IN. Dept. of Sociology and Anthropology.
H. R. Potter, and H. J. Norville.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 336, Price codes: A03 in paper copy, A01 in microfiche. Purdue University Water Resources Research Center Technical Report No. 115. January 1979. 42 p, 38 tab, 51 ref, 1 append. OWRT A-043-IND(1).

Descriptors: *Decision making, Social aspects, Social values, Social function, *Citizens participation, *Public participation.

The report focuses on how citizen participants perceive the effectiveness of their participation in natural resources decision making, comparing very, moderately and slightly active participants. Data are from personal interviews with 77 very and moderately active persons, and from mailed questionnaires to 106 moderately and slightly active participants from throughout Indiana. The operational measure of extent of participation used for data analysis was hours per week spent on environmental activities, which had a fairly strong relationship to other indicators of participation. Participants generally viewed their participation as effective, on a series of measures. Very active citizens were more effective than slightly active participants; they also used more participation techniques more often than the slightly active participants. Most effective techniques involved direct contact with decision makers, the press and others, and knowledge of issues. Public hearings, advisory boards, courts and lawyers, bumper stickers and buttons, and protest demonstrations were considered much less effective. They felt governmental agencies are changing, and becoming more responsive. Very active participants tended to have more positive views of agencies, particularly of state and federal agencies. Most participants saw no financial benefits associated with participation, although many saw losses, often associated with the costs of participation.
W79-04493

WATER SYSTEMS AND THEIR EMERGENCIES,
California Univ., Irvine. School of Engineering.
G. Urbach, R. Schinzinger, T. Edwards, and H. Fagin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 416, Price codes: A04 in paper copy, A01 in microfiche. Emergency Water Allocation Project Working Papers No 12, 13 and 14, 1978, 101 p, 21 fig, 5 tab. (California Water Resources Center Project UCAL-WRC-W-498). OWRT B-178-CAL(7).

Descriptors: *Water shortage, *Water supply, *Rationing(Water), Water management, Disasters, Accidents, Earthquakes, California.

The Emergency Water Allocation Project (EWAP) at the University of California at Irvine has been working for the past three years on a systematic approach to the development of an effective Water Emergency Response System. The site for pursuing and applying these investigations has been the San Diego region, an area considered representative of many growing urban areas which import most of their water from outside sources. Described are the methods developed to identify vulnerable aspects of a water system, and to introduce a systematic emergency preparedness process. A conceptual model of the water system and its operating environment is presented and steps necessary to implement an emergency allocation plan for scarce water and restoration resources are reviewed. Methods are described for analyzing the vulnerability of a network and for pinpointing critical elements that warrant strengthening or for which redundant paths should be provided. An Emergency Resources Directory for use by member agencies of the San Diego County Water Authority is included. (Snyder-California)
W79-04497

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE EFFECTS OF INLAND NAVIGATION USER CHARGES ON BARGE TRANSPORTATION OF WHEAT,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
J. K. Binkley, J. Havlicek, Jr., and L. A. Shabman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 993, Price codes: A06 in paper copy, A01 in microfiche. Virginia Polytechnic Institute and State University, Blacksburg. Research Division Bulletin 137, 1978. 107 p, 4 fig, 14 tab, 46 ref, 2 append. OWRT B-082-VA(2).

Descriptors: *Use rates, Navigation, Inland waterways, *Transportation, Costs, Wheat.

This study evaluated the effect of inland navigation user charges on barge wheat movements on both the Mississippi River system and particular segments of the system. Transshipment models were constructed, examining three wheat varieties: hard red spring, hard red winter, and soft red winter. The models permitted two types of movements from producing to consuming areas: direct movements or movements through river transshipment points. This allowed the models to choose between barge transportation and competitive modes. Consuming regions were comprised of domestic milling points and foreign countries. Exports to any given point were allowed to move through any of several U.S. ports, depending upon relative transport costs. This gave the models a great deal of flexibility in the export sector, which is critically important for barge transportation of wheat. Data used included 1970-71 wheat production and consumption, and 1975 barge and rail rates, truck costs, and handling costs for each mode. User charges were based on 1974 operation and maintenance costs of the inland waterway system and 1974 barge ton-miles. Base solutions were obtained for each of the models, and then each was run with user charges recovering from 25 to 500 percent of annual operation and maintenance. The effects of uniform charges and charges specific to each waterway were examined. Results were: (1) Few wheat movements were significantly affected by uniform charges recovering 100% of costs, with a moderate reduction in total barge wheat traffic, (2) specific charges seriously reduced wheat traffic on certain high cost rivers, but brought about a moderate reduction of wheat movements on the total system.
W79-04075

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME II, APPENDIX A: ECONOMIC DATA AND ANALYSIS.
Army Engineer District, Portland, OR.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 961, Price codes: A10 in paper copy, A01 in microfiche. Review Report on Umpqua River and Tributaries, December 1971. 140 p, 46 tab, 15 fig, 4 plates, 19 photos, one of 5 volumes.

Descriptors: *Water resources development, *Multiple-purpose reservoirs, *Economics, *Cost-benefit analysis, *Planning, *Water quality, *Umpqua River(OR), *South Umpqua River(OR), Oregon, Cost comparisons, Flooding, Flood damage, Benefits, Fish management, Recreation, Water quality control, Irrigation, Water supply, Municipal water, Local governments, Industrial water, Construction, Population, Employment, Income, Reservoirs, Non-structural alternatives, Area redevelopment, Housing, Educational facilities, Structural alternatives, Cost repayment.

This Appendix A has as its purpose the summarization of procedures, projections, and basic economic data that would accrue to a multiple-purpose reservoir in the Umpqua River Basin. In the analysis, 1985 was assumed for project year one. The major water resource problems in the area are flooding, caused by too much water in the winter months and too little water in midsummer and fall. This basin's economic base and growth projections are detailed through population, employment, income, and principal industries. A history of the basin's flood problems and an inventory of existing flood problems leads to an average annual damage calculation; future flood damages are projected using earlier growth data. Alternative solutions to the flood problem are reviewed with flood control benefits attached. Benefits attached to a number of other purposes are then studied: recreation, fishery mitigation and enhancement, water quality control, municipal and industrial water supply, irrigation, and area development. A net benefit maximization model is developed, and results of the maximization study are presented. Costs are then evaluated in a cost-benefit analysis. Final cost allocations are made, and repayment methods are suggested. A last chapter details local economic effects during construction by looking at characteristics of the local economy, construction employment and expenditures, population and income effects, and impacts upon population, housing, educational facilities, and local governments. (Zayac-NC)
W79-04140

WATER WELLS HELP TEXAS CITY SAVE MONEY.
For primary bibliographic entry see Field 6B.
W79-04247

LIABILITY FOR OIL POLLUTION UNDER THE MERCHANT SHIPPING (OIL POLLUTION) ACT 1971,
Aberdeen Univ. (Scotland).
For primary bibliographic entry see Field 6E.
W79-04425

THE USE OF CIVIL PENALTIES IN ENFORCING THE CLEAN WATER ACT AMENDMENTS OF 1977,
For primary bibliographic entry see Field 6E.
W79-04449

6D. Water Demand

A CROSS-SECTIONAL INVESTIGATION OF THE DETERMINANTS OF URBAN RESIDENTIAL WATER DEMAND IN THE UNITED STATES, 1960 AND 1970,
Texas A and M Univ., College Station. Water Resources Inst.
H. S. Foster, Jr., and B. R. Beattie
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 714, Price codes: A04 in paper copy, A01 in microfiche. Technical Report-86, May 1978. 60 p, 4 fig, 8 tab, 34 ref, 1 append. OWRT A-999-TEX(7).

Descriptors: *Water demand, *Municipal water, *Cities, *Model studies, Mathematical models, Economics, Water rates, Planning, Estimating, Economic impact, Statistics, Least squares method, Regression analysis.

An economic model was developed relating residential demand for urban water to its determinants. Theoretical and statistical properties of alternative models were considered in selecting the variables and specifying the functional form of the model. Parameters of the model were estimated on the basis of pooled data representing a cross section of U.S. cities. Dummy variables were incorporated to estimate a regionalized version of the model, and for estimates of size of city effects. The hypothesis, water demand is invarient among regions, was tested and rejected; the hypothesis, water demand is invariant among size-of-city categories, could not be rejected. The models were fitted using 1960 and 1970 data and ordinary least squares regression techniques; the explanatory variables, price, income, precipitation (during the growing season), and the number of residents per meter, were included. Income and price elasticities are given for all regions at the mean price level and for one standard and deviation above and below the mean price level. (Davison-IPA)
W79-04003

MULTIPLE USE OF IRRIGATION CANALS,
Utah State Univ., Logan. Coll. of Natural Resources.
J. J. Kennedy, and S. Morgan.
Utah Science, Vol. 36, No. 2, p 71-73, June 1975. 3 fig. OWRT-A-017-UTAH (3).

Descriptors: *Canals, *Recreation, *Cache Valley(Utah), *Legal aspects, Public access, Management, Fishing, Fisheries, Adverse possession, Wastes, Recreational wastes, Litter.

Irrigation canals in Cache Valley, Utah, are filling the recreational needs of a large section of the population consisting of children and senior citizens. The multiple uses of the canals have generated conflicts between the canal owners, the recreational users, and landowners adjacent to the canals. In some areas, landowners monopolize sections of the canals, excluding the public, and depositing large amounts of trash in the form of grass and shrubbery clippings in the canals. Recreational users contribute a small amount of refuse to the canals, and some citizens groups are concerned about the accidental drownings that occasionally occur. The canal companies have thus far maintained the canals, but the problems of liability for recreation users and the implications for canal management is becoming increasingly important. It is suggested that cooperative agreements between canal companies and public agencies may shift some of the management and maintenance responsibility to the public. It is reported that unless cooperative action is taken, the canal companies may restrict the general public's use of the canals. (Davison-IPA)
W79-04096

ENERGY AND WATER RESOURCES.
Oregon State Univ., Corvallis. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 887, Price codes: A06 in paper copy, A01 in microfiche. January 1977. Fall Quarter Seminar, 1976. 122 p, 44 fig, 32 tab, 47 ref. OWRT-A-999-ORE(22).

Descriptors: *Water resources, *Water management(Applied), *Oregon, *Energy, Water requirements, Conservation, Agriculture, Solar radiation, Irrigation, Thermal water, Hydroelectric plants, Columbia River Basin, Pacific Northwest, Waste water treatment, Diversion, State government, Regional development, Planning.

A compilation of papers from a weekly series exploring some issues involving water needs and energy development is presented. The Water Resources Research Institute on the Campus of Oregon State University serves the state in fostering, encouraging and facilitating water research; it administers and coordinates multidisciplinary state and regional reseach programs in water and related land resources. Topics covered are: water requirements for energy development; energy, water resources, and agriculture; energy conservation in irrigation; geothermal energy and water resources; solar energy and water resources; hydro-power and pumped storage in the Northwest; energy and water diversion; energy consumption of advanced waste water treatment; and the impact of irrigation on the Columbia River. (Davison-IPA).
W79-04112

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, SUMMARY REPORT.
Big Muddy River Basin Coordinating Committee, IL.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 946, Price codes: A09 in paper copy, A01 in microfiche. May 1971. 116 p, 8 fig, 11 tab, 3 plates, 2 exhibits.

Descriptors: *Big Muddy River Basin(IL), *Regions, *River basin development, *Agricultural watersheds, *Forest watersheds, *Watersheds, *Watershed management, Water resources development, Water supply, Water allocation(Policy), River flow, Flow augmentation, Floods, Water quality, Planning, Land use, Conservation, Environmental control, Reservoirs, Illinois, Recreation.

This study was undertaken to establish a comprehensive plan to encourage conservation, development and optimum use of the Basin's water and land resources. It examines the needs for comprehensive plan formulation and development for the 10-county area in extreme southern Illinois. The area is expected to remain rural in character over the next 50 years, with mining and agriculture being the major industries. Evaluation between projected demands and existing or planned supplies indicated four overall categories of needs requiring resource management and/or development--agricultural enhancement; low flow stream management; recreation combined with area redevelopment; and environmental control. Action programs were proposed for each category, including developments for agricultural enhancement designed to control floodwater on farmland; programs to maintain stream quality and flow quantity, and a program to maintain a minimum base flow in areas which could suffer from objectional sanitary conditions over time; establishment of outdoor recreational opportunities to meet state and local needs, and to enhance the area's economic base; and an environmental control program designed for preservation of historic and archaeologic sites, conservation of wildlife habitats, improvement and protection of public health, and rehabilitation of stripmined areas. Recommendations included an immediate Corps of Engineers Basin-wide study of stripmining problems; implementation of proposed structural and non-structural improvements, including construction of reservoirs, improvement of stream corridors, and land treatment programs; and incorporation of appropriate elements of the Basin Plan into programs of involved federal, state and local agencies. (Arnold-NC)
W79-04143

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, VOL. 7, APPENDIX M AND N.
Big Muddy River Coordinating Committee, IL.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 945, Price codes: A10 in paper copy, A01 in microfiche. Appendix M: Plan Formulation, 118 p, 32 tab, 3 fig, 4 plates, formal comments. Appendix N: Benefit Evaluation, 30 p, 14 tab, formal comments. 1970.

Descriptors: *Big Muddy River Basin(IL), *River basin development, *Regional economics, *Economic benefits, *Water resources development, *Watershed management, Water supply, Water quality, Cost-benefit analysis, Environmental corridors, *Outdoor recreation, Illinois, Recreation, Recreation development, Planning, Land use, Flood control, Environmental quality, Land treatment.

This study was undertaken to establish a comprehensive plan of development for the Basin's water and land resources of the Big Muddy River Basin, a 10-county area in Southern Illinois. Appendix M examines the plan formulation process. Basin needs and planning goals and objectives are presented, followed by a discussion of the solutions considered. Needs include flood control, land management and treatment, low-flow augmentation, outdoor recreation, wildlife conservation, and environmental quality control. Recommendations to meet the needs of the Basin include structural improvements such as reservoirs, levees, and channelization for flood control; flood plain zoning; at source treatment of effluents to improve water quality; increased recreation development; and the need for consideration of proper conservation programs for the Basin. Benefit-cost ratio data were formulated on the basis of potential growth in recreation opportunities. Recreation is seen as a major growth industry in the area, and portions of the Basin are proposed as Special Recreational Environmental Corridors, suitable for development chiefly for outdoor recreation activities. Appendix N attempts to quantify needs of the Basin to be fulfilled if it is to achieve its growth potential. National account benefits and regional account benefits for the various programs are set out in detail. Of the total benefits, 44% are national in character, basically derived from flood control measures. The remaining 56% of the projected benefits are to be derived by the localities from growth in response to development of new water-related projects. (Arnold-NC)
W79-04144

PLANNING FOR WATER RESOURCES,
Thames Water Authority, London (England).
D. Perret.
Long Range Planning, Vol 10, No 2, p 65-72, April 1977, 8 fig, 2 tab, 7 ref.

Descriptors: *Water management(Administrative), *Thames Water Authority, *England, *Wales, *Water policy, *Planning, *Water resources, *Water resources development, *Administration, Multiple use policy, Water law, Economics, Models, Water demand, Water supply.

This article recounts the history of water resource law and administration in England and Wales from 1945 to the present estsablishment of 10 regional water authorities to deal with water planning from a multiple purpose standpoint. The Thames Water Authority is described as an example. The Authority consists of a board, 6 resource committees, a quality advisory panel, and separate finance and personnel subcommittees. Actual management of day-to-day administrative operations and water resource planning are carried out through the separate Thames Water Management structure and planning organization, respectively. The planning organization is composed of the Strategic Plan Group, which determines planning goals and produces a Strategic Plan for water resources; the Development Plan Group, which assembles and evaluates proposals; the Economic Studies Group, which prepares economic forecasts and analyses of the demand for Authority services; the Central Information Group, responsible for managing information exchange within the Authority and for producing the Authority's reports; the Operational Research Group, charged with analyzing Authority policy; and the Water Resources Group, a subgroup of the Operational Research Group, which evaluates future options for water resources and makes final recommendations to the Authority using a model of the present water resource system. The Authority needs the aforementioned administrative/management framework to cope with Britain's water quantity problems, particularly those arising from recent droughts. Consideration of the relative merits of different proposals and their interaction, given the many complexities involved, will require the use of multimaterial modelling. (Arnold-NC)
W79-04152

YOU NEVER MISS THE WATER ... TILL THE WELL RUNS DRY,
S. M. DeForge.
Dun & Bradstreet Reports, p 16-25, September

1977.

Descriptors: *Water shortage, *Water quality, *Desalination, Water treatment, Water conservation, Water management, Water pollution, Water supply development, Water utilization, Irrigation, Industrial water, Saline water intrusion, Pipelines, Coal mines, Safe Drinking Water Act, Distillation, Membrane processes, Crystallization, Icebergs.

Facts and statistics related to the availability and utilization of water resources both in developed and underdeveloped regions around the world are presented. Problems of increased consumption of water for irrigation, salt water intrusion, unequal distribution of water, and industrial pollution are overstraining over freshwater supplies. New techniques to conserve, manage and distribute surface and ground-water supplies include: diversion of rivers; 'trickle' irrigation; covering soil and reservoirs with a film to retard evaporation; underground storage; and recycling used water. Energy-related industries consume enormous amounts of water. 'Coal slurry' pipelines are a threat to the water resources of the Rocky Mountain states since one ton of water is needed to transport one ton of coal. The implementation of the Safe Drinking Water Act of 1974 by the E.P.A. should effect the improving of water treatment systems, regular sample analyses for bacterial and chemical content, and enforcement of water-quality standads. Various water-treatment processes are described. Three methods of desalination; distillation, membrane process, and crystallization are compared. Presently, desalination is feasible only in oil-rich nations. Alternatives to desalination are towing icebergs from Antarctica or filling empty oil tankers with fresh water. (Purdin-NWWA)
W79-04244

WATER SYSTEM DESIGN FOR A LOW YIELD WELL,
Hanson Drilling Co., Inc., Vancouver, WA.
For primary bibliographic entry see Field 8A.
W79-04250

AGRICULTURE: ITS HISTORIC AND CONTEMPORARY ROLES IN ARIZONA'S ECONOMY,
Arizona Univ., Tucson. Dept. of Geography.
M. E. Hecht, R. W. Reeves, and N. De Gennaro.
Arizona Review, Vol. 27, No. 11, p 7-12, November 1978. 1 fig, 1 tab.

Descriptors: *Agriculture, *Regional economics, *Economic impact, Crop production, Arable land, History, Land use, Livestock, Employment opportunities, Soils, Water resources development, Water shortage, Water allocation(Policy), Arizona.

The agricultural history, natural resources, climate and settlement patterns of Arizona are described in this analysis in order to put Arizona's past and present agricultural development in perspective. Although farming has long been an important industry in Arizona as evidenced by the fact that today more than half of state land is used for agricultural production, it is important to point out that much of this is used for low intensity livestock ranching, with crop production accounting for only 2% of the land use. Employing only 2.3% of the state's workers, crop production is by far the major consumer of the state's most critically limited resource: water. Three elements of the state's natural environment, water, soil and climate, are the most influential factors determining the course of the state's agriculture with water being the most limiting factor. This examination of the role of agriculture, both today and in the past, is helpful in explaining the position of the farmer in the complex problem of the state's water resource allocation. Trends emerging from this analysis are: (1) while other state industries have experienced rapid growth, agriculture has continued without major economic growth or locational changes, (2) the number of people employed by this industry, (3) losses slightly declining although crop acreage has shown a moderate increase, (3) losses in farmland to urban expansion has been compensated for by growth on the periphery and in the Yuma area, and (4) changes in crop acreage have reflected changing market conditions, with cotton and cattle presently the principal commodities. (Tickes-Arizona)
W79-04281

POTENTIAL POTABLE-WATER SUPPLIES IN REDWOOD NATIONAL PARK,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. P. Akers.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225 paper copy $4.50, microfiche $3.50. Geological Survey open-file report 78-970, November 1978. 27 p, 12 fig.

Descriptors: *Groundwater, *Water quality, *Water supply, *Evaluation, *National parks, Groundwater availability, Potable water, California, *Redwood National Park.

An evaluation was made of the potential for potable-water supplies at 13 sites in or near Redwood National Park, Calif. The National Park Service is planning the development of visitor facilities at these sites. At some sites, locations are given for test-well drilling or springs are recommended for development. Chemical analyses of water from selected surface-water supplies and from some wells and springs show that the water is suitable in most places, although concentrations of iron and chloride are excessively high in some areas. (Woodard-USGS)
W79-04393

CALIFORNIA V. UNITED STATES (STATE RESTRICTIONS ON FEDERAL APPROPRIATION OF WATER UPHELD),
98 S. Ct. 2985-3011 (1978).

Descriptors: *Permits, *Federal-state water rights conflicts, *Appropriation, *Federal reclamation law, Impounded waters, Dams, Water distribution(Applied), California, Arid lands, Water resources, Irrigation, Water allocation(Policy).

The United States Bureau of Reclamation applied to the California State Water Resources Control Board for a permit to appropriate water that would be impounded by the New Melones Dam. Congress specifically directed that the dam be constructed and operated pursuant to the federal Reclamation Act of 1902, which established a program for federal construction and operation of reclamation projects to irrigate arid western land. The Bureau's application was approved, but subject to state imposed restrictions. The United States then brought an action seeking a declaratory judgment that the federal government may impound whatever unappropriated water is necessary for a federal reclamation project without complying with state law. The District Court held that the United States was required to apply for an appropriation permit but that the permit must be issued without conditions if there was sufficient unappropriated water. The Supreme Court reversed. The Court held that, under the 1902 Reclamation Act, a state may impose any condition on control, appropriation, use of distribution of water in federal reclamation project which is not inconsistent with clear congressional directives respecting the project. (Hucks-Florida)
W79-04427

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

UNITED STATES V. STATE OF NEW MEXICO (IMPLIED RESERVATION OF WATER DOCTRINE HELD TO COVER ONLY AMOUNT OF WATER NECESSARY FOR THE PURPOSE OF THE RESERVATION).
For primary bibliographic entry see Field 6E.
W79-04453

6E. Water Law and Institutions

ACTION PROGRAMS FOR WATER YIELD IMPROVEMENT ON ARIZONA'S WATERSHEDS: POLITICAL CONSTRAINTS TO IMPLEMENTATION,
Arizona Univ., Tucson. School of Renewable Natural Resources.
H. J. Cortner, and M. P. Berry.
In: Hydrology and Water Resources in Arizona and the Southwest, Vol. 8, p 45-52, 1978, Proceedings of the 1978 Meetings of the Arizona Section of the American Water Resources Association and the Hydrology Section of the AAS, Flagstaff, AZ, April 14-15. OWRT A-072-ARIZ(4), 14-34-0001-7005 and 7006.

Descriptors: Water yield, Watershed management, Decision-making, Institutions, Arizona, Vegetative modification, Interest groups.

Three successful attempts to implement large-scale action programs for water yield improvement on Arizona's watersheds are described. Two programs were thwarted after release of state-of-the-art research reports, the 1956 Barr Report and the 1974 Ffolliott-Thorud Report, both of which were designed to provide the basis for program implementation. Another ongoing action program involving treatments of pinyon-juniper and chaparral and creation of fuel breaks was halted in progress. The factor which contributed to these failures are examined. These include, for example: overstated program goals; unrealistic assumptions about the political feasibility of treatment types, extent and intensity; failure to recognize the emergence of new decision-making participants; and unsettled questions concerning program costs and beneficiaries.
W79-04093

SPECIAL WATER RIGHTS FOR INDIANS: PRINCIPLE VERSUS CONFUSION,
California Univ., Los Angeles. Dept. of History.
N. Hundley.
In: Navajo Nation Energy Conference, Tsaile, Arizona, May 2, 1977. p 7-13, 1977. Conference Proceedings, LA-6927-C-Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico. (California Water Resources Center Project UCAL-WRC-W-516). OWRT-A-059-CAL(1).

This report provides a measure of historical perspective by sketching the events that led to the U.S. Supreme Court announcement that there is a special Indian water right. The review also offers some reasons for the confusion that continues to surround that right and calls for an equitable, clear resolution. (Snyder-Calif)
W79-04121

ACCOMPLISHMENT PLAN, REGION VIII, COMPREHENSIVE ENERGY-ENVIRONMENT PROGRAM.
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 454. Price codes: A03 in paper copy, A01 in microfiche. June 1975. 45 p, 5 append.

Descriptors: *Regional planning, *Water quality control, *Energy, *Natural resources, Water pollution, Air pollution, Coal, Uranium, Oil shale, Water resources, Environmental impacts, Water quality management, Montana, North Dakota, South Dakota, Wyoming, Utah, Colorado, 208 areawide planning, Energy resources, Project planning.

One half of the nation's coal reserves, 40% of the economically recoverable uranium reserves, and all commercially feasible oil shale resources are located in EPA Region VIII. The development of these energy resources has significant environmental impacts. Pressures to develop these resources are accelerating. This Accomplishment Plan is a continuation of the FY '74 and '75 Accomplishment plans which focus on the development of

ese resources. The plan emphasizes a balanced rogram incorporating environmental monitoring, chnical investigations, control technology evalu- ion, impact prediction, environmental planning, d regulatory program development. The report ts funding summaries for all aspects of the plan d additional funding needed for new programs. large section of the report lists major constitu- nts of the FY '76 Regional Management Plan. his includes objectives, output/tasks, funding vels, staff support, and schedules for completion tasks. Objectives include developing resource onitoring systems; formulating coordinated envi- nmental management plans for high priority pact areas; identifying, monitoring, and coordi- ting energy research activities; and other goals. sks needed to achieve these objectives are listed ith funding, scheduling, and needed staff support. he interdivisional functional relationships of or- nizations involved with the Accomplishment an are listed with their appropriate functions. ee also W79-04138) (Coan-NC)
79-04137

CCOMPLISHMENT PLAN. REGION VIII. OMPREHENSIVE ENERGY-ENVIRONMENT ROGRAM. APPENDIX,
nvironmental Protection Agency, Denver, CO. egion VIII.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB-256 454, rice codes: A03 in paper copy, A01 in microfiche. ne 1975. 73 p.

escriptors: *Water quality control, *Water pollu- on, *Air pollution, *Regional planning, *Energy pact, *Energy, *Montana, *Colorado, *North akota, *South Dakota, *Wyoming, *Utah, Energy resources, Environmental impacts, Natu- l resources, Coal oil shale, Project planning, Air llution abatement, Waste pollution abatement, round water, 208 Area-wide planning, Environ- ental maintenance funding.

his report is an appendix to a foregoing study on e minimization of environmental damage while eveloping energy resources in Region VIII. It ntains charts of the organization structure of the ffice of Energy Activities for Region VIII and e 208 planning areas in the Region, including aps of the designated areas. Surface water quality onitoring programs for oil shale and coal re- urce areas are listed with data on field measure- ents, chemical, biological and physical param- ers, nutrients, metals, organic carbons, and ygen demand; and maps showing the monitoring ograms in the energy resource areas. Maps and bles present locations of, and data on, ground- ater and air quality monitoring stations in the egion. A section on contracts summary presents e contract, amount funded, description of the ntract, and present status of the contract for FY 75. The final section describes the energy re- urces in Region VIII, the amount of these re- urces, the geographic location of the deposits, obable production of the resources, and the pro- ctive capacity of the Region compared to the st of the nation. (See also W79-04137) (Coan- C)
79-04138

OUTH PLATTE RIVER BASIN ACCOM- LISHMENT PLAN.
nvironment Protection Agency, Denver, CO. egion VIII.
or primary bibliographic entry see Field 5G.
79-04145

LANNING FOR WATER RESOURCES,
ames Water Authority, London (England).
or primary bibliographic entry see Field 6D.
79-04152

HE CANADA WATER ACT ANNUAL EPORT, 1977-1978.
epartment of Fisheries and Environment, Ottawa ntario).
78, 36 p.

Descriptors: *Water quality, *Water quality control, *Water law, *Water resources planning, *Water resources management, *Water quality management(Administrative), *Western Canada, *Canada Water Act, Water rights, River basins, Management, Institutions, Water resource research, Public information, Nutrients, Water shortage, Droughts, Canada, Governmental agreements, Data management.

This report covers operations performed under the Canada Water Act up to March 31, 1978. It describes the full provisions under the Act and briefly discusses the individual programs which have been or are expected to be undertaken to meet these provisions. These provisions provide for formal federal-provincial consultative arrangements for water resource matters and for cooperative agreements with the provinces for development and implementation of comprehensive plans for the management of water resources. The programs described include planning studies, implementation agreements, flood damage reduction measures, and other cooperative arrangements. Activities related to the Canada Water Act but not objectives in themselves are also discussed. These include socio-economic studies, water research projects, the study of non-point pollution sources, collection of water data, and development of data management systems. Other provisions of the Act provide for water quality management programs, the regulation of nutrient inputs, and establishment of public information programs. A short section describes the impact of and outlook toward the drought in Western Canada beginning in September 1976 and a longer section describes the principal Federal-Provincial cooperative arrangements under the Canada Water Act. (Coan-NC)
W79-04154

PRECIPITATION MANAGEMENT AND THE ENVIRONMENT, AN OVERVIEW OF THE SKYWATER IX CONFERENCE.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2B.
W79-04157

HILL REESTABLISHMENT: RETROSPECTIVE COMMUNITY STUDY OF A RELOCATED NEW ENGLAND TOWN,
New Hampshire Univ., Durham. Water Resources Research Center.
For primary bibliographic entry see Field 6B.
W79-04158

ELECTRIC POWER DEVELOPMENT IN THE PACIFIC NORTHWEST REGION: INSTITUTIONAL COMMITMENTS AND ALTERNATIVES, PHASE 2,
Washington Univ., Seattle. Inst. for Environmental Studies.
K. N. Lee, M. E. Marts, and D. L. Klemka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 151, Price codes: A08 in paper copy, A01 in microfiche. State of Washington Water Research Center, Washington State University, Pullman, Completion Report, January 1979. 156 p, 3 fig, 1 tab. OWRT A-080-WASH(2), 143-34-10E-3996-3048.

Descriptors: Public policy, *Electric power, Bonneville Power Administration, *Energy policy, Pacific Northwest, Water resource development, *Regional development, *Institutional constraints.

This report extends the work done in an earlier Water Research Center Study of regional electric power planning in the Pacific Northwest (See W77-03288). During 1977 and 1978 a complex set of legislative packages was introduced and debated in Congress and the region. These proposals aimed at comprehensive revision of institutional structure of electric power allocation and planning in the Northwest; the existing structure is based on the Bonneville Project Act of 1937, and has been revised incrementally since then, as described in the earlier report. None of these legislative reformulations was successful, and the 95th Congress adjourned with a commitment to take the question of regional power planning again in 1979. With interregnum prevailing in the region, there is need for evaluating the alternatives proposed, as well as development of new institutional concepts. Discussed are (1) premises for institutional redesign; (2) functions that must be carried at the regional level; (3) prospects for alternative institutional orders emerging from the present political deadlock. In particular, it is argued that the costs and environmental impact on regional energy development will keep power planning enduringly controversial. Accordingly, leadership at the regional level will need to play a larger, more visible role than in the past. Two means by which such leadership might be given the institutional strength needed are (1) reallocation of low-cost federal hydropower on an incentive basis, rather than by either public or residential preference; or (2) encouragement of a regional wholesale power market.
W79-04159

208 WATER QUALITY PLANNING HOW IT WILL AFFECT YOU,
North Carolina State Univ. at Raleigh.
F. J. Humenik.
Irrigation Journal, Vol. 28, No. 3, p 6-7, 17, 24, 25, May-June, 1978.

Descriptors: *Legal aspects, 208 Act, Water pollution control, Water pollution sources, Waste water disposal, Waste water treatment, Water quality control, *Water resources planning act, Planning.

208 is actually a section of Public Law 92-500, the Federal Water Pollution Control Act Amendment of 1972. General goals of this sweeping legislation are to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. A comprehensive discussion of 'Section 208' is presented in this article. (Skogerboe-Colorado State)
W79-04193

NON-POINT POLLUTION AND THE SCS,
Agricultural Engineering, Vol. 59, No. 5, p 19-20, May, 1978.

Descriptors: *Non-point pollution, Water pollution sources, Pollution abatement, Soil conservation, Legal aspects, Return flow.

Agricultural Engineering interviews Glen H. Loomis, PE, director of the Environmental Services Division of USDA-SCS, on the Culver Amendment to the Clean Water Act. (Skogerboe-Colorado State)
W79-04197

WATER SYSTEMS COUNCIL: A VARIETY OF SERVICES TO PUMP MANUFACTURERS AND THE WATER WELL INDUSTRY,
For primary bibliographic entry see Field 4B.
W79-04240

UPDATE: WHAT'S IN THE WATER.
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5F.
W79-04242

GEOTHERMAL GOES EAST,
For primary bibliographic entry see Field 3C.
W79-04248

A CASE FOR REAPPRAISAL OF INDIAN WATER POLLUTION STANDARDS AS APPLICABLE TO PULP AND PAPER INDUSTRY,
Central Pulp Mills Ltd., Fort Songad (India).
N. S. Sadawarte, and A. K. Prasad.
Indian Pulp and Paper, Vol. 32, No. 6, p 9, 11-13, 15-17, April/May, 1978. 7 tab.

Descriptors: *Pulp and paper industry, *Water quality standards, *India, Foreign countries, Wastes, Industrial wastes, Water pollution sources,

Biochemical oxygen demand, Pulp wastes, Effluents, Water pollution, Standards, Water policy.

It is concluded that present Indian water pollution standards are too rigid and too general, as well as tougher than those of highly industrialized countries such as Canada and Australia with regard to BOD (kg/ton) discharges from pulp and paper mills. No limits are specified for permissible pollution loads based on type of pulping process, age and location of mills, or nature of receiving streams. Standards are urged that would be sufficiently flexible to judge each mill on its specific circumstances, at the same time, serve to protect the environment without jeopardizing industrial growth. (Brown-IPC)
W79-04255

PROTECTING INSTREAM FLOWS UNDER WESTERN WATER LAW: SELECTED PAPERS.
Cooperative Instream Flow Service Group, Fort Collins, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 993, Price codes: A04 in paper copy, A01 in microfiche. Report No FWS/OBS-77/47, September 1977. Edited by B. L. Lamb. 64 p, 1 append.

Descriptors: *Streams, *Streamflow, *Water quality control, Legal aspects, Water law, Water rights, Western United States, Water Quality Act, Appropriation doctrine, Instream flows.

Five papers suggesting means to protect flows under existing water law and projects development in water law regarding instream flows are presented. These papers were originally presented as a panel at the Western Association of State Game and Fish Commissioners and the Western Division, American Fisheries Society Annual Meeting in Tucson, Arizona, July 13, 1977. The appendix contains a matrix of all strategies for protecting instream flows identified in a recent contract with the Western Energy and Land Use Team of the U.S. Fish and Wildlife Service. (Davison-IPA)
W79-04275

PROGRESS OF PROTECTION OF THE ENVIRONMENT AND RESOURCES IN THE UNITED STATES-A HISTORICAL SURVEY,
Naval Sea Systems Command, Washington, DC.
O. A. Meykar.
IEEE Transactions on Aerospace and Electronic Systems, Vol. AES-10, No. 4, p 521-532, July 4, 1974. 7 ref.

Descriptors: *Legislation, *Environmental control, *Water quality act, *Water pollution control, Federal Water Pollution Control Act, Water law, Rivers and Harbor Act, Clean Air Act, Public health service.

Legislative action on the state and federal levels meant to improve and preserve environmental quality and conserve natural resources, including water resources, was developed and implemented in a logical sequence, synchronized with social development and consciousness of the need for specific legislative, punitive, or constructive actions. The needed legislation was developed through a consensus of opinion, wants, and costs that were to be incurred by those parties affected. At times, the Federal Government was obliged to increase its budget allocations in areas where immediate relief was necessary and large losses expected. (Leibowitz-FIRL)
W79-04278

INSTITUTIONAL ASPECTS OF WATER RESOURCES MANAGEMENT AT SUBSTATE LEVEL,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., D. Rosen, and L. Champney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 307, Price codes: A02 in paper copy, A01 in microfiche. Final Technical Completion Report. January 1979, 20 p, 28 ref. OWRT A-054-NJ(1), 14-34-0001-9032.

Descriptors: *Institutions, *Water supply, Water quality control, *Land use, Governments, Water policy.

This study investigates institutional aspects of water supply/water quality/land use problems in rapidly urbanizing areas, particularly in New Jersey. Recent areawide water quality planning under section 208 of the National Water Pollution Control Act and the start of preparation of a statewide water supply master plan are bringing to light problems which the local, state and regional institutions are not well adapted to handle. Currently available institutions have been evaluated, emerging alternatives have been evaluated, and comparisons have been made of widely different solutions in different areas. Alternative possibilities for improved institutions have been considered.
W79-04309

FEDERAL RESERVED RIGHTS AND THE INTERSTATE ALLOCATION OF WATER,
C. Dirck.
Land and Water Law Review, Vol. 13, No. 3, p 813-833, 1978. OWRT A-027-WYO(3), 14-34-0001-8054.

Descriptors: Reservation doctrine, *Water rights, *Water allocation, Water law, Prior appropriation, Federal reservation, State jurisdiction.

In 1899, the United States Supreme Court allowed the federal government to take water for federal lands without compensating those from whom the water was taken. Today, the problem of allocating the burden of federal reserved rights among the several states of an interstate water basin is an important one. In searching for a solution, interstate compacts must be first examined. Some provide for certain reserved rights to be charged against a particular state's allocation; others do not mention the manner in which federal reserved rights are to be satisfied. Even those that do address the question may have been formed before the nature and extent of the reserved rights were understood, thereby creating other problems. The legal status of reserved rights are reviewed beginning with the original application of the doctrine in 1908 to a river running through an Indian Reservation. In 1963, the Supreme Court extended applications of the doctrine to other federal reservations, such as national parks, forests, and wildlife refuges. In 1976, the Court applied the doctrine to groundwater. Several recommendations are made for alleviating the burden the doctrine places on states. (Stump-Florida)
W79-04346

MARKETING OF SURPLUS WATER FROM FEDERAL RESERVOIRS,
J. M. Dunn.
Land and Water Law Review, Vol. 13, No. 3, p 835-861, 1978. OWRT-A-027-WYO(2), 14-34-0001-8054.

Descriptors: Missouri River, *Water allocation, Political aspects, Industrial water, Prior appropriation, Reservoirs.

In 1944, Congress authorized a plan for the development of the water resources of the Missouri River Basin. At that time the major consumptive use was anticipated to be irrigation, and that is how the water has been used. However, irrigation planned for upper basin states has not been pursued, resulting in unappropriate surplus water available for commitments to future uses. In 1975, the Secretaries of the Army and Interior signed a 'Memorandum of Understanding,' for the purpose of permitting the possible sale of surplus water for industrial purposes. The Secretary of the Interior would determine how much water from the reservoirs that has been allocated to irrigation is in excess of that needed for present and predicted future irrigation needs. The Secretary of the Army would then determine how much of that excess could be made available for industrial uses. No mention is made of state participation in this decision making process. This has generated fear among western states that state policies will be ignored and local benefits sacrificed by federa takeover of this part of the state governments function. (Stump-Florida)
W79-04347

AMERICAN DREDGING COMPANY V. STATI DEPARTMENT OF ENVIRONMENTAL PRO TECTION (ORDER BANNING DUMPING O DREDGE SOIL IN PROTECTED WETLAND AREA UPHELD),
For primary bibliographic entry see Field 5G
W79-04415

NATIONAL FORESTS DO NOT HAVE RE SERVED WATER RIGHTS FOR RECRE ATIONAL PURPOSES,
J. Noble.
Natural Resources Journal, Vol. 18, No. 2, p 423 26, April, 1978.

Descriptors: *Federal reservations, *National for ests, *Reservation doctrine, *Judicial decisions Public lands, Forests, Federal government, Feder al-state water rights conflicts, Water rights, Publi benefits, Recreation, Water demand.

The New Mexico Supreme Court applied the re served rights doctrine to National Forests i Mimbres Valley Irrigation Co. v. Salopek, whic arose as a private action to enjoin diversions o water from a stream. The reserved rights doctrine first put forth in Winters v. United States, wa applied to the Gila National Forest in Arizona v California, when the U.S. Supreme Court state that the principle of reservation of water right applied to other federal establishments. Most re cently, in Cappaert v. United States, the Court sai that federal reservation of appurtenant water ex tended to that needed to accomplish the purpose o the reservation. This test was used in Mimbre Valley to determine the quantity of water re served. The purposes of the National Forests in clude improving and protecting the forest, secu ing favorable conditions of waterflows, and fu nishing a continuous supply of timber. The cou found that recreation and minimum instream flo were not purposes for which the Gila Nationa Forest was created. The U.S. Supreme Cou granted certiorari, but in the meantime, the Gil National Forest is allowed little water, and th public has effectively been denied recreational us of the area. (Rule-Florida)
W79-04417

WHO OWNS OUR BEACHES,
A. Wolff.
Saturday Review, Vol. 5, No. 21, p. 22-24, July 2 1978.

Descriptors: *Beaches, *Public access, *Californi *Resource allocation, Public rights, Proprietar power, Recreation facilities, Recreation demand Easements, Coasts, Shores.

Access to beaches is a growing controversy i coastal areas. Longstanding common law and co stitutional private property rights are being cha lenged by public claims to an equitable share in th seashore. The problem is not a physical shortage o shoreline; rather, it is that most beach property privately owned and off limits to the public. Whi according to the common law of most states th ocean below the high water line is held in trust b the state for public use, the beach itself may b privately owned and restricted to private us Rising property values and increasing public nee for recreational facilities have combined to crea the present conflict. At the same time that ope beach advocates are pressing for greater publ access to beaches, owners of beach-front proper are tenaciously resisting what they perceive t assaults on their property rights. Among the mea ures which have been instituted to counter ope beach movements are residency-restrictions an access fees to use the beach. This article presen both sides of the beach access controversy, focu ing on the current problem in California. (Huck Florida).
W79-04418

HE LEGAL SIGNIFICANCE OF THE LOCAL OVERNMENT COMPREHENSIVE PLAN,
. Arline.
978, 26 p., Available from Eastern Water Law enter University of Florida, Gainesville, Florida, 2611, $1.75.

escriptors: *Florida, *Comprehensive planning, ocal governments, *Land development, Water sources, Legal aspects, Judicial decisions, oning, Water policy, Environmental control, lanagement, Legislation.

he 1975 Florida Local Government Comprehen- ve Planning Act (LGCPA) mandates comprehen- ve land-use planning on the local level. Local overnments are required to establish and imple- ent a comprehensive plan for their area of juris- iction by July, 1979. A local planning agency is to repare the plan for adoption by the local govern- g body. Municipalities and counties can develop int plan. The comprehensive nature of the plan, cluding nine required and 11 optional elements, is scussed and analyzed in detail. The LGCPA andates that all development--private and ublic--and all governmental action that impacts the land, must be 'consistent' with the plan. lorida courts will be called on to determine what ction is 'consistent' with a particular plan. The GCPA's success will therefore depend in part on e courts' willingness to review local land-use ecisions--something they have traditionally avoid- d doing by applying a 'presumption of validity' st. While the LGCPA is threatened by the ourts' abstention from local land-use disputes, it is oped that this tradition will change as has the adition of local land-use control. (Easterbrook-lorida)
/79-04420

DAHO'S ENVIRONMENT (PROBLEM OF NFETTERED EXPLOITATION RIGHTS V. NVIRONMENTAL CONCERN),
or primary bibliographic entry see Field 5D.
/79-04421

PA PROPOSED FAR-REACHING REGULA- IONS FOR REDUCING SYNTHETIC ORGAN- CS IN DRINKING WATER.
or primary bibliographic entry see Field 5F.
/79-04422

LASKA OIL DISCHARGE PREVENTION ND POLLUTION CONTROL ACT HELD IN- ALID CHEVRON U.S.A. INC. V. HAMMOND,
D. Kimball.
ournal of Maritime Law and Commerce, Vol. 10, o. 2, p 289-92, January, 1979.

escriptors: *Alaska, *Oil pollution, *Legislation, Federal jurisdiction, Judicial decisions, Oil spills, afety, Regulation, Pipelines, Ships, Design stand- rds.

he Trans-Alaska Pipeline opened in 1977. To deal ith the potential threat of oil spills in Alaskan aters accompanying the expected heavy volume tankers, the state enacted the Alaska Oil Dis- harge Prevention and Pollution Control Act. This ct required that tankers operating in Alaska be quipped with specific safety and maneuvering ca- bility features. The statute also required tankers carry a 'risk avoidance certificate', issuance of hich was contingent upon provision of evidence financial responsibility to meet liability limits set the state, and payment of an annual 'risk harge.' However, in Ray v. Atlantic Richfield ompany, the U.S. Supreme Court held Washing- n state's tanker law invalid because it was pre- mpted by the federal Ports and Waterways Safety ct of 1972. The Court stated that Congress in- nded uniform national safety standards for tank- s that would foreclose the imposition of different more stringent state requirements. An the Dis- ict Court in Chevron U.S.A., Inc. v. Hammond eld that the equipment requirements of the Alaska ct were invalid due to similar pre-emption. The ourt also refused to view the risk charges as an insurance program instead of a state regulatory scheme. (Horwich-Florida)
W79-04424

LIABILITY FOR OIL POLLUTION UNDER THE MERCHANT SHIPPING (OIL POLLUTION) ACT 1971,
Aberdeen Univ. (Scotland).
D. J. Cusine.
Journal of Maritime Law and Commerce, Vol. 10, No. 1, p 105-22, October, 1978.

Descriptors: *Oil pollution, *Oil spills, *International commissions, *Damages, Water pollution, Water pollution control, Oil, Common law, International law, Cost repayment, Insurance, Legislation.

At common law, considerable difficulties were experienced in attempts to recover damages for oil pollution caused by discharges from ships. The International Convention on Civil Liability for Oil Pollution Damage (Liability Convention) provides that the owner of a ship shall be liable for any pollution damage caused by oil which has escaped or been discharged from a ship at the time of an incident. The 1971 Merchant Shipping (Oil Pollution) Act provides a code governing civil liability for oil pollution from ships. However, although the Act solves, to a great extent, the problem of the common law, its terms themselves give rise to difficulties. The Act creates liability in respect to discharges from ships carrying oil as cargo, but it does not impose liability for oil discharged from ballast. The Act is not very clear on the question of the responsibility of persons other than owners, especially salvors. The Act appears to attempt to exclude from liability everyone other than the owner, even when the owner does not attract liability. The Act was imprecisely drafted and is almost certain to give rise to considerable litigation. (Fortin-Florida)
W79-04425

COASTAL COMMUNITIES - PARTNERS OR PUPPETS IN OUTER CONTINENTAL SHELF DEVELOPMENT,
Delaware Univ., Newark. Coll. of Urban Affairs and Public Policy; and Delaware Univ., Newark. Coll. of Marine Studies.
R. Warren.
Coastal Zone Management Journal, Vol. 4, No. 1/2, p 119-25, 1978.

Descriptors: *Continental shelf, *Local governments, *Resources development, *Governmental interrelations, Oil industry, Oil wells, Research priorities, Offshore platforms, Coastal structure, Planning/judicial decisions.

A decision was recently made at the national level to accelerate the development of oil and gas resources on the outer continental shelf. Cities and counties were effectively excluded from this decision-making process. Beyond the fact that research assumed that affected communities would be supportive of development, serious questions have been raised about the utility of studies for state and local administrators and decision-makers. There is an almost complete vacuum with respect to the information available to local officials about the locational intentions of companies that will be involved in exploratory and later stages. Some communities are far from being favorable or even neutral to new energy facilities and are willing to expend time, money and expertise to prevent such development. If there is to be a middle ground between local veto politics and imperial federalism, coastal communities in general, and especially those directly affected, must become recognized participants in public-sector policy making. This can be facilitated by state and federal planning grants, fostering multi-city and county planning efforts, state technical support, and attention by national local governmental and professional organization to provide information about planning and management techniques. (Fortin-Florida)
W79-04426

WHICH WAY TO THE BEACH. PUBLIC ACCESS TO BEACHES FOR RECREATIONAL USE,
M. L. Bryan.
South Carolina Law Review, Vol. 29, No. 4, p 627-65, September, 1978.

Descriptors: *South Carolina, *Public access, *Beaches, *Management, Erosion, Prescriptive rights, Permits, Right-of-way, Coasts, Accretion, Recreation, Comprehensive planning.

By the public trust doctrine expressed in Cape Romain Land and Improvement Co. v. Georgia-Carolina Co. and subsequent case and statutory law, the public's right to use the South Carolina foreshore for recreational purposes is clear. The controls imposed on dry-sand beaches below the vegetation line by the South Carolina Coastal Zone Management Act place that land in trust for the people to protect the land from erosion, resulting in preservation of the beaches for continued recreational use. But historically, conflicts concerning public access to beaches have arisen when rights-of-way to the shore or particular areas of dry-sand beach were enclosed or obstructed so that people could not reach the foreshore where the public's right-to-use were clear. Successful actions to confirm public rights under these circumstances in South Carolina on any theory of prescription, dedication, or custom will require extensive proof of continued use. South Carolina may avoid some of the problems that have produced litigation elsewhere by the comprehensive planning mandated by the State and federal coastal zone management acts. Ways to do this--through use of permitting authority, erosion control authority, and local ordinances--are examined. (Horwich-Florida)
W79-04435

FLOATING NUCLEAR PLANTS - A 'REASONABLE USE' OF THE HIGH SEAS,
M. J. Blake.
California Western International Law Journal, Vol. 8, No. 2, p 191-227, Spring, 1978.

Descriptors: *Nuclear powerplants, *Law of the Sea, *Oceans, *Environmental effects, Marine animals, Marine plants, Pollutants, Reasonable use, Fishing, Radioative wastes, Thermal pollution, Nuclear wastes.

Expanding world energy needs are rapidly depleting the earth's energy bearing natural resources. In response, nations have been seeking and studying alternative energy sources. Nuclear energy is one such source. To avoid environmental, site planning, and cost problems, the idea of placing nuclear power plants on the ocean has gained serious consideration. These plants have been called 'floating nuclear plants' (FNPs). FNP construction, which includes dredging, has the direct environmental effect of destroying biological communities. FNP operation will affect marine life because of the pressure and temperature of the water expelled in the cooling processes. Chemicals and metals are also discharged. The author, in giving a legal analysis of this controversial use of the high seas, discuss the historical international law of the high seas and the provisions of the Third United Nations Conference on the Law of the Sea. Basically, freedom of the high seas has been limited by reasonable use and due consideration for other states. It is essential that the 'reasonableness' test, and the other customary legal concepts discussed, be expanded to meet such environmental dangers as those presented by the FNP concept. (Horwich-Florida)
W79-04436

ROBBINS V. LAKE OSSIPEE VILLAGE, INC. (BEACH USE AND RIGHT-OF-WAY RESEVATIONS IN DEED UPHELD).
389 A. 2d 940-43 (N.H. 1978).

Descriptors: *New Hampshire, *Easements, *Beaches, Access routes, Coasts, Land development, Facilities, Construction, Properties, Right-of-way.

Plaintiff landowner brought this action seeking declaratory and injunctive relief. The plaintiff claimed the defendant corporation could not restrict plaintiff's use of certain beach property owned by the defendant and that he (plaintiff) could not be assessed for his use of the property or beach facilities located on it. When the plaintiff conveyed land to the defendant, plaintiff reserved a 120,000 square foot parcel and a right-of-way to the beach on part of the conveyed property. Defendant planned to subdivide and develop the property. The beach was to be a common area for lot purchasers and the plaintiff. The plaintiff objected. The trial court ruled in favor of the defendant corporation. On appeal, a Court Master reversed. Affirming the Master's pro-plaintiff ruling the New Hampshire Supreme Court ruled that: (1) the plaintiff could place restrictions on the defendant's beach facilities; (2) the deed reserved a right-of-way and a right to use and enjoy the beach in the plaintiff; and (3) the defendant's failure to file restrictions on time resulted in a loss of the right to impose any restrictions on the plaintiff's deed reservations. (Goldberg-Florida)
W79-04437

APPROPRIATION FOR INSTREAM FLOW MAINTENANCE: A PROGRESS REPORT ON 'NEW' PUBLIC WESTERN WATER RIGHTS,
Indiana Univ., Bloomington.
A. D. Tarlock.
Utah Law Review, Vol. 1978, No. 2, p. 211-47, 1978.

Descriptors: *Riparian waters, *Prior appropriation, *Flow system, *Water utilization, Recreation, Wildlife management, Navigable waters, Water conservation, Water law, Water rights, Uniform flow, Stream flow.

In 1975 the dedication of water to instream uses such as fish and wildlife maintenance and recreation was a growing but still minor factor in western water law. The question of whether instream uses would be recognized in the prior appropriation and western riparian system was open. Since 1975, it has become clear that instream uses will be recognized in western water law. The issues are now, how, and to what extent these new uses will be recognized. This article contains an analysis of instream use recognition and protection. Topics discussed are: (1) the philosophy of instream preservation; (2) instream flow preservation standards; (3) elimination of per se barriers to flow preservation appropriations; (4) flow preservation strategies including wild and scenic river programs and federal reserved rights, expanded state definitions of navigable waters, public interest qualifications on appropriations applications, direct state instream use fillings, and water conservation programs. (Goldberg-Florida)
W79-04438

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
J. F. McNulty, Jr.
Wake Forest Law Review, Vol. 14, No. 3, p 662-77, June, 1978.

Descriptors: *Effluents, *Water pollution control, *Federal water pollution control act, *Judicial decisions, Industrial wastes, Impaired water quality, Inorganic compounds, Industrial water, Water policy, Water treatment standards, Regulation.

The 1972 Federal Water Pollution Control Act Amendments, which completely revised and expanded prior federal water pollution control legislation, are analysed in light of the extreme difficulties experienced with respect to their implementation. Two recent federal court decisions interpreting the 1972 amendments characterized the statutory language as suffering from disquieting ambiguities and containing 'statutory language devoid of plain meaning'. A Supreme Court case--E. I. DuPont de Nemours Co. v. Train--analyzed herein examines the structure of the Act and its ambiguities, focusing on the crucial question of who has the authority under the 1972 Act to set binding effluent discharge regulations for industrial water users. In Dupont, the court gave the federal Environmental Protection Agency power to establish binding national effluent limitations. To accomplish this result the Court engaged in judicial legislation by inferring regulatory powers withheld by Congress in drafting the 1972 Act. The writer concludes that such judicial legislation is undesirable in that it forecloses action in the political arena and retards the development of a true national consensus on difficult issues. (Goldberg-Florida)
W79-04439

CONSERVATION AND THE NEW INFORMAL COMPOSITE NEGOTIATING TEXT OF THE LAW OF THE SEA CONFERENCE,
C. De Klemm.
Environmental Policy and Law, Vol. 4, No. 1, p. 2-17, April 1978.

Descriptors: *Negotiations, *Law of the Sea, *United Nations, *Conferences, Marine animals, Preservation, Ecosystems, Pollution, Exploration, Exploitation, Coasts, Continental shelf.

Negotiations for a new world treaty on the Law of the Sea have been taking place in the United Nation Conference on the Law of the Sea. What is essentially at stake is the extension of sovereign rights over a 200-mile wide Exclusive Economic Zone (EEZ) and over a continental shelf of at least similar width; a monopoly of the coastal states on the resources of those zones; and an important share for developing nations, of the mineral resources of the sea-bed beyond the limits of the coastal-state jurisdiction. The results of the negotiations have been incorporated in a new Informal Composite Negotiating Text (ICNT). This paper is a preliminary analysis of the ICNT, from the point of view of the conservation of marine ecosystems and species. The major gap in the new Law of the Sea draft, from the conservation point of view, is the almost complete absence of any provision relating to the preservation of marine ecosystems. Yet some positive elements also appear; for instance, all aspects of pollution are now taken into consideration in the ICNT. Other provisions of the ICNT are discussed. (Horwich-Florida)
W79-04440

BALANCING THE INTERESTS. THE THIRD UN-LAW OF THE SEA CONFERENCE - (7TH SESSION),
A. R. H. Schneider, L. Kimball, J. C. Bridgeman, and G. Graham.
Environmental Policy and Law, Vol. 4, No. 2, 3, p. 69-77, July, 1978.

Descriptors: *Law of the Sea, *Negotiations, *Treaties, *United Nations, Continental shelf, International waters, Mining, Fishing, Exploration, Exploitation, Pollution, Research facilities.

The third United Nations Law of the Sea Conference (UNCLOS 111), seventh session, decided in April, 1978, on the structure of its negotiations. Conference participants decided to concentrate on seven 'hard-core' issues: Deep sea-bed mining; financial arrangements; organs of the proposed International Sea-Bed Authority; access of land-locked (and other) states to fisheries in the 200-mile exclusive economic zones (EEZ); dispute settlement in regard to coastal states' rights in the EEZ; the continental shelf; and maritime boundaries. Seven special negotiating groups were set up by the participants, and their subject areas defined. Each such group's developments are herein reported. The negotiating time of this session was five weeks. Of the seven negotiating groups set up to deal with key issues, only the one on dispute settlement over fishing rights in the EEZ was able to report that it had fulfilled its mandate. The chairman of most of the others reported progress and suggested tests of treaty articles which they thought might offer a better prospect for consensus; but with the one group as an exception, all groups indicated that further negotiations would be needed at the next treaty session. (Horwich-Florida)
W79-04441

WATER ALLOCATION: CONSTRAINTS AND OPPORTUNITIES,
H. R. Doerksen.
Fisheries, Vol. 2, No. 1, p. 14-16, Jan.-Feb., 1977.

Descriptors: *Water allocation(Policy), *Wildlife management, *Competing uses, *Resources development, Beneficial use, Fish conservation, Fisheries, Resource allocation, Planning, Appropriation, Reservation doctrine, Energy.

In western states, where water resources are scarce, policies relating to water allocation often conflict. One major source of conflict is over the use of water to promote energy development at the expense of fish and wildlife resources. Traditional doctrines of water allocation stress energy development as more important than the preservation of fish and wildlife. Proponents of wildlife management must understand the policies behind western water law doctrines in order to effectively participate in water allocation decisionmaking. Several mechanisms used to allocate water which affect fish and wildlife are examined. These include interstate compacts, construction of federal reservoirs, implied reservation pursuant to specific state and federal programs and private appropriation subject to state laws. Doctrines such as first-in-time first-in-right, beneficial use, necessary diversion and perpetual right are defined and discussed. The need for cooperation between competing interest groups rather than conflict as a means of achieving mutually beneficial and satisfying results is stressed. Rather than viewing the situation in terms of good and bad, a recognition that competing self-interests can be reconciled and result in mutual progress is urged. (Hucks-Florida)
W79-04442

NOTES ON CALIFORNIA'S COASTAL GOVERNANCE: A REPLY TO PETER DOUGLAS,
California Univ., Berkeley. Inst. of Governmental Studies.
For primary bibliographic entry see Field 6A.
W79-04444

CESSATION OF RETURN FLOW AS A MEANS OF COMPLYING WITH POLLUTION CONTROL LAWS,
R. G. Berger.
Public Land and Resources Law Digest, Vol. 15, No. 1, p 52-78, 1978.

Descriptors: *Water pollution control, *Consumptive use, *Waste water disposal, *Beneficial use, Water reuse, Prior appropriation, Municipal wastes, Cost-benefit theory, Evaporation, Reasonable use, Water quality standards, Federal water pollution control act.

With the increasingly stringent effluent limitations of the 1972 Federal Water Pollution Control Act, some municipalities and industrial plants are finding it more economical to cease all water discharge than to restore it to the required quality standard. These total containment, no-discharge pollution control systems substitute evaporation of water from sewage and industrial effluent for treatment and discharge of purified water. All opportunities for subsequent use of the water downstream are thereby terminated. Questions of policy and legality with respect to these systems are examined. Underlying water laws and policies is the goal of obtaining 'maximum social satisfactions' from the water. To achieve this goal, rules of reasonable use and beneficial use have developed. When an established water user in a prior appropriation jurisdiction seeks to implement a total containment system, it must be determined whether this change which increases consumption is a reuse or more efficient use - which is contingent on preserving the rights of others. Other legal, economic, and policy considerations are discussed. (Horwich-Florida)
W79-04445

FEDERAL LANDS AND CONSISTENCY: AN INTERGOVERNMENTAL PLANNING PROPOSAL FOR THE COASTAL ZONE,
For primary bibliographic entry see Field 6A.

W79-04446

TO ESTABLISH A NATIONAL WATER POLICY.
Hearings, Subcommittee on Water Resources, Committee on Environment and Public Works, U.S. Senate, March 31, April 6, 7, 11, 12, 14, 18, 1977, Serial No. 95-H16, 1402 p, app.

Descriptors: *Water demand, *Water management(Applied), Water shortage, *Water policy, Legislation, Water conservation, Surface waters, Water delivery, Future planning(Projected).

These hearings before the U.S. Senate Subcommittee on Water Resources of the Committee on Environment and Public Works attempt to formulate and establish a National Water Policy. At present, there is no well defined National Water Policy. It is a hazy, non-definitive federal effort fragmented among several agencies. The issues addressed herein include: (1) how to prepare for the water needs of a rapidly growing population; (2) provision for emergency, short term situations such as drought; (3) how should responsibility be allocated between federal, state and local bodies; (4) how to strike a balance between the competing needs of industrial and municipal water supply, the environment, hydroelectric power and agriculture for limited supplies of water; and (5) what is being done to find new sources of water for the future. All testimony heard before the committee is included along with maps, graph and tables. (Goldberg-Florida)
W79-04447

THE USE OF CIVIL PENALTIES IN ENFORCING THE CLEAN WATER ACT AMENDMENTS OF 1977,
T. O'Brien.
University of San Francisco Law Review, Vol. 12, No. 3, p 437-63, Spring, 1978.

Descriptors: *Civil law, *Pollution abatement, *Cost analysis, Federal water pollution control act, Regional economics, Environmental control, Judicial decisions, Constitutional law, Damages, Economics.

Society at large now bears the 'social cost' of pollution. Civil penalties are an attempt to meet the challenges of incorporating the externality of pollution into the free market system. The price tag for pollution is now determined by governmental administrators and is ultimately very subjective. Several enforcement methods--legal solutions to the pollution problem--have been tried with varying degrees of success. These include: private damage suits; injunctions; criminal sanctions; and civil penalties. Civil penalties appear to be a very effective tool in enforcing environmental policy, particularly that policy embodied in the 1977 Clean Water Act Amendments. Economically, they are superior to other methods of pollution control because they can accurately incorporate the costs of pollution into the free market system without substantially disrupting it. Legally, civil penalties are flexible and easy to apply; their civil statutes reduces pleading and proof problems and streamlines administrative processes. At the same time, civil penalties neither abridge violators' constitutionally guaranteed protection against self-incrimination nor deny them the due process of law. (Fortin-Florida)
W79-04449

STATE LAW, NOT FEDERAL, DETERMINES RIPARIAN RIGHTS TO ACCRETIONS,
P. J. Ward.
North Dakota Law Review, Vol. 54, No. 3, p 505-14, 1978.

Descriptors: *Riparian land, *Riparian rights, *Accretion, *Judicial decisions, Riparian waters, Avulsion, Erosion, Watercourses(Legal aspects), North Dakota, Common law, Land forming, Water rights.

The law as to riparian owners as it relates to accretion, erosion, and dereliction, as well as avulsion and reliction, is discussed. The development of Supreme Court decisions on these issues is examined and their effect upon state powers is explained. The focus of the discussions is upon the case of Oregon ex rel. State Land Board v. Corvallis Sand & Gravel Co. and the earlier case of Benelli Cattle Co. v. Arizona, which it overruled. The Court ruled in Corvallis that state property law governs riparian ownership, unless some other principle of federal law would require a different result. This reliance upon state law allows for the legislating state to acquire title to increasing portions of land through use of the above theories without later being subject disfeasence. If states take the initiative to change their accretion laws, riparian owners on oceans, lakes, and rivers of this country could, in a matter of time, be separated by state land from the waters which were once the boundaries of their land. (Fortin-Florida)
W79-04450

FLORIDA BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND V. WAKULLA SILVER SPRINGS COMPANY.
362 So. 2d 706-13 (Fla. Ct. App. 1978).

Descriptors: *Florida, *Boundary disputes, *Meanders, *Surveys, Mangrove swamps, Wetlands, Boundaries(Property), Adjacent land owners, High water mark, Legal aspects, Erosion.

A declaratory court action was sought to determine the boundary line separating adjacent tracts of land owned by the plaintiff company and defendant state organization. The tract in question owned by the plaintiff is bounded on three sides by water. It was admitted that the defendant owned adjoining submerged lands. Plaintiff claimed its waterfront lands were conveyed to its predecessors in title by deeds incorporating the plat of the original United States survey of the area. Plaintiff admitted the 'mean high water line' (MHWL) was the actual boundary; however plaintiff claimed the MHWL could not be located accurately because the lands are low, wet mangrove swamp. At a nonjury trial, extensive findings of fact and conclusions of law were made before the court--ruling in favor of the plaintiff--declared the boundary line between the two tracts to be the meander line of the original 1872 United States survey of the area, subject to any subsequent natural changes such as accretion, erosion or reliction. On appeal, the judgement was affirmed in total. (Easterbrook-Florida)
W79-04451

POPE V. CITY OF ATLANTA (ACT REGULATING CONSTRUCTION IN RIVER FLOOD PLAIN HELD NOT TO BE UNCONSTITUTIONAL TAKING OF PROPERTY WITHOUT COMPENSATION).
249 S.E. 2d 16-21 (Ga. 1978).

Descriptors: *Constitutional law, *Surface runoff, *Georgia, *Flood plains, Legislation, Runoff, Rivers, Construction, Water pollution control, City planning, Erosion control, Eminent domain.

Plaintiff property owner brought an action against defendant city, claiming the city's Metropolitan River Protection Act was unconstitutional in that it prohibited plaintiff's construction of a tennis court within the flood plain of the Chatahoochee River. Defendant had issued a stop-work order pursuant to the Act, which required a certificate of compliance for any clearing, construction, excavation, or filling in the stream corridor. After the order was upheld by a federal district court, plaintiff claimed the Act unconstitutionally appropriated private property for public use without compensation. The Georgia Supreme Court held the Act constitutional finding that the inherent police power of the state extends to protection of the public interest, and that unlike eminent domain, the use of the state's police power involves the regulation of property to prevent its use in a manner detrimental to the public interest. Since soil erosion and sediment were major pollution problems in the Chatahoochee, and clearing could increase surface water run-off and erosion, the public interest was served by regulating this activity. Additionally, construction of impervious structures in the flood plain increased runoff, erosion, and the risk of flooding. (Rule-Florida)
W79-04452

UNITED STATES V. STATE OF NEW MEXICO (IMPLIED RESERVATION OF WATER DOCTRINE HELD TO COVER ONLY AMOUNT OF WATER NECESSARY FOR THE PURPOSE OF THE RESERVATION).
98 S. Ct. 3012-26 (1978).

Descriptors: *Federal-state water rights conflicts, *New Mexico, *Reservation doctrine, *National forests, Water rights, Water resources, Surface waters, Water supply, Federal reservations, Water allocation(Policy), Federal government.

The State of New Mexico brought suit to determine its rights, and the rights of the United States, to water of the Rio Mimbres River. The river originates in the upper Gila National Forest, flows southward past more than 50-miles of privately owned lands, and provides substantial irrigation and mining water. The federal government claimed reserved water rights for use in the Gila National Forest. The Supreme Court held that the federal government in setting aside the national forest lands, reserved use of the water only where necessary to preserve timber in the forest or to secure favorable water flows, and did not reserve rights for aesthetic, recreational, wildlife preservation, or stock watering purposes. Although the power to reserve portions of the federal domain for specific federal purposes impliedly authorizes the reservation of appurtenant water, the implied reservation of water doctrine covers only that amount of water necessary to fulfill the purpose of the reservation. Because water in the West is scarce, and more than 50 percent of the available water originates in or flows through national forests, the narrow terms of national forest reservations must be followed. (Rule-Florida)
W79-04453

FEDERAL WATER POLLUTION CONTROL ACT DISCHARGE PERMIT SYSTEM - AN INDUSTRIAL VIEWPOINT,
J. A. Evans.
Natural Resources Lawyer, Vol. 10, No. 4, p 761-67, 1978.

Descriptors: *Federal water pollution control act, *Judicial decisions, *Analysis, *Water quality standards, Permits, Pollution abatement, Standards, Technology, Administrative agencies, Legislation, Water pollution control.

The most important feature of the Federal Water Pollution Control Act (FWPCA) affecting industry is the discharge permitting system--the NPDES permit program. To deal with the important provisions of discharge permits, Sections 301, 304 and 402 of the FWPCA's 1972 Amendments must be considered. Section 301 requires the federal Environmental Protection Agency (EPA) to establish effluent limitations for point discharge sources by July, 1977. Application is required by the 'best practicable technology' available. By July, 1983, effluent limitations must be established which require application of the best available technology economically achievable. Section 304 requires the EPA to establish 'guidelines for effluent limitations' which should 'identify the degree of effluent reduction attainable through the application of best practicable control technology currently available for classes and categories of point sources'. Section 402 requires a NPDES permit for any discharge. Although the EPA has read Sections 301 and 304 in connection with each other and concluded that one set of regulations can satisfy each section, industry has disagreed with EPA's conclusion. These sections and the issues surrounding them have been the subject of much litigation. Prominent cases are discussed and analyzed. (Easterbrook-Florida)
W79-04454

BUREAU OF RECLAMATION REQUIRED TO COMPLY WITH CALIFORNIA WATER ALLOCATION PROCEDURES,
R. L. Puglisi.
Natural Resources Journal, Vol. 18, No. 2, p 727-30, April, 1978.

Descriptors: *Federal reclamation law, *Reclamation, *Appropriation, *Judicial decisions, California, Unappropriated water, Water rights, Projects, Water law, Federal-state water rights conflicts, Water utilization.

The Supreme Court has recently agreed to review the case United States v. California. Federal district and appeal courts ruled in the case that the federal Bureau of Reclamation need not comply with state water laws in obtaining water to be used for federal reclamation projects but will be legally required to file in accordance with state laws in order to determine the availability of water and to give adequate notice of the project. This decision was supported by Hancock v. Train, which basically held that federal installations are subject to state regulations only where Congressional intent to do so is clear and unambiguous. Congressional intent to require federal reclamation projects to submit to state control regarding water permits and conditions subsequent was not clear and unambiguous in the 1902 federal Reclamation Act. The impact of U.S. v. California--a case of first impression--is not wholly clear. The decision was significant in terms of rejecting state conditions on new permits for unappropriated water in federal reclamation projects. Yet presently, most of the water in the West is already appropriated; therefore, the practical consequences of the decision could be miniscule. (Easterbrook-Florida)
W79-04455

HUELSMANN V. STATE (RECOVERY DENIED FOR LOSS OF WELL WATER CAUSED BY HIGHWAY CONSTRUCTION).
For primary bibliographic entry see Field 2F.
W79-04456

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
Hearing, Subcomm. on Environmental Pollution, Committee on Environment and Public Works, U.S. Senate, June 6, 1977, Serial No. 95-H25, Part 3, 399 p.

Descriptors: *Water treatment, *Federal water pollution control act, *Evaluation, *Water quality, Financing, Water pollution treatment, Cost allocation, Water quality standards, Regulation, Permits, Pollution abatement.

This hearing before the U.S. Senate Subcommittee on Environmental Pollution took testimony from the public on what amendments, if any, should be made to the Federal Water Pollution Control Act (FWPCA). The hearing focused on two issues: municipal and industrial compliance with the FWPCA. Also examined were alternatives to the national uniform secondary treatment standard for municipalities and the related question of how federal financing might relate to that flexibility. The questions addressed were: (1) Should the law provide flexibility in the secondary treatment standard for those communities who can develop a more efficient and economical alternative; (2) How are the comparative benefits of such an alternative to be determined; (3) How should the federal government fund such alternatives; (4) How are federal funds allocated; and (5) Should states be required to assist smaller communities in these endeavors. Other issues examined were: (1) the extent to which current programs will achieve the basic goal of the federal Clean Water Act; and (2) the effects of compliance with the FWPCA's 1977 best-practicable-treatment technology requirement, and 1983 best-available treatment technology requirements. All testimony heard before the Subcommittee is included, along with maps, graphs and charts. (Goldberg-Florida)
W79-04457

DEVELOPMENT OF THE HARD MINERAL RESOURCES OF THE DEEP SEABED.
Hearings, Subcomm. on Mines and Mining, Committee on Interior and Insular Affairs, U.S. House of Reps., March 29, April 4 and 5, and May 12, 1977, Serial No. 95-7, 642 p.

Descriptors: *Mining, *Oceans, *Negotiations, *Law of the sea, Mineral industry, International law, International waters, Conferences, United Nations, Ownership of beds, Treaties.

These hearings before the U.S. House of Representatives' Subcommittee on Mines and Mining were held to discuss House Bills 3350 and 3652--two bills dealing with the development of the hard mineral resources of the deep seabed. Bill 3350 is a bill to promote the orderly development of hard mineral resources in the deep seabed, pending the adoption of an international regime relating thereto. Bill 3652 is a bill to insure the development of United States ocean mining capabilities and to support the continuation of the United Nations' Law of the Sea Conference negotiations. All testimony heard before the committee in included along with maps, graphs and tables. Development of the mineral resources of the sea which lie beyond the boundaries of any nation has been the subject of extensive international discussion and negotiations. Most of the negotiating has occurred at the Law of the Sea Conferences. Testimony expressing the position of the nation's private industrial sectors, was given. All testimony given before the Subcommittee is included verbatim, along with maps, graphs and tables. (Goldberg-Florida)
W79-04458

WATER SYSTEMS AND THEIR EMERGENCIES,
California Univ., Irvine. School of Engineering.
For primary bibliographic entry see Field 6B.
W79-04497

6F. Nonstructural Alternatives

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME II, APPENDIX A: ECONOMIC DATA AND ANALYSIS.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6C.
W79-04140

COASTAL COMMUNITIES - PARTNERS OR PUPPETS IN OUTER CONTINENTAL SHELF DEVELOPMENT,
Delaware Univ., Newark. Coll. of Urban Affairs and Public Policy; and Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 6E.
W79-04426

6G. Ecologic Impact Of Water Development

MOVEMENTS OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) IN IMPOUNDED WATERS AS DETERMINED BY UNDERWATER TELEMETRY,
Mississippi State Univ., Mississippi State.
For primary bibliographic entry see Field 2H.
W79-04016

DREDGED MATERIAL RESEARCH PROGRAM, FOURTH ANNUAL REPORT.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 409, Price codes: A07 in paper copy, A01 in microfiche. Report, January 1977. 165 p.

Descriptors: *Environmental effects, *Dredging, *Research priorities, Environmental engineering, Environment, Research facilities, Water, On-site investigations, Wetlands, Marsh management, Projects, Disposal, Effects, Water quality, Habitats, Marsh development.

The objectives of the Dredged Material Research Program are to provide, through research, definitive information on the environmental impact of dredging and dredged material disposal operations and to develop technically satisfactory, environmentally compatible, and economically feasible dredging and disposal alternatives, including consideration of dredged material as a manageable resource. Specific goals are to establish definitively the effects of open-water, land, and wetland disposal on water quality and organisms; to test and evaluate concepts of marsh development and land and water habitat development as environmentally beneficial disposal alternatives; to improve and enhance the acceptance of confined land disposal as an alternative and to consider regulation of the dredging/disposal operation as an environmental control measure; and to develop and test concepts for using disposal sites for productive purposes and to consider the use of dredged material as a natural resource. Presented in the report was detailed information on the status of the DMRP up to January 1, 1977. Highlights of 1976 were accented, objectives of the field studies were emphasized and illustrated, and attention was given to results achieved or anticipated. (See also W78-04534) (Froehlich-ISWS)
W79-04044

PLANNING FOR PROPER USE OF LAND AND WATER.
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 6A.
W79-04113

ACCOMPLISHMENT PLAN, REGION VIII. COMPREHENSIVE ENERGY-ENVIRONMENT PROGRAM.
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 6E.
W79-04137

ACCOMPLISHMENT PLAN, REGION VIII. COMPREHENSIVE ENERGY-ENVIRONMENT PROGRAM. APPENDIX,
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 6E.
W79-04138

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME I: MAIN REPORT.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 4D.
W79-04139

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME II, APPENDIX A: ECONOMIC DATA AND ANALYSIS.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6C.
W79-04140

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME IV, APPENDICES E THROUGH J, REPORTS OF COORDINATING AGENCIES.
Army Engineer District, Portland, OR.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 963, Price codes: A12 in paper copy, A01 in microfiche. Review Report on Umpqua River and Tributaries, OR, December 1971. 260 p, one of 5 volumes.

Descriptors: *Water resources development, *Multiple-purpose reservoirs, *Umpqua River(OR), *South Umpqua River(OR), *Environmental impacts, Oregon, Archeology, Water quality, Turbidity, Forest management, Fish management, Wildlife management, Irrigation, Land management, Environmental effects, Dam construction, Days Creek(OR), Fish and Wildlife Service, Environ-

ıental Protection Agency, Bureau of Reclamaon, Bureau of Land Management, Forest service, lational Park Service, Reservoirs, Recreation.

hese appendices are detailed reports by the coopating agencies participating in the study. Appenix E, by the Fish and Wildlife Service, details the gnificant effects that the proposed Days Creek am and reservoir project would have on fish and ildlife resources. It was suggested that fish and ildlife conservation and development be included s a project purpose. Appendix F, by EPA, reiewed the report with respect to a change in site or the South Umpqua dam and reservoir from the iller Reservoir site to the Days Creek site; any ıajor changes in the economic and demographic rojections used for the earlier siting; current ater quality standards; and policy changes in valuating project-associated benefits. Recommenations are that turbidity potential be studied furıer; multi-level reservoir outlets be provided for shery purposes; and water quality monitoring icilities be provided. Appendix G consists of corespondence from the Bureau of Reclamation to ıe Corps detailing estimates of irrigation water equirements and storage benefit data for use in ormulation studies for the Umpqua River Basin eport. Appendix H, by the Bureau of Land Mangement, presents the impacts that construction of ıe Days Creek project would have on resources, rograms, and lands administered by the Bureau. ppendix 1, by the Forest Service, studies the roject impact on management of Forest Service nds and the overall effects of the project on the nvironment, resources, and local economy. The orest Service finds that the project would be ompatible with its duties. Appendix J, by the lational Park Service, details the results of a urvey of the archeological potential of the proosed sites, concluding that the Days Creek site as fewer archeological materials than its alternave. (Zayac-NC)
V79-04141

NTERIM REPORT, SOUTH UMPQUA RIVER. RANSCRIPT OF PUBLIC MEETINGS.
rmy Engineer District, Portland, OR.
or primary bibliographic entry see Field 6B.
V79-04142

OMPREHENSIVE BASIN STUDY: WHITE IVER BASIN - ARKANSAS AND MISSOURI. OL. 1, MAIN REPORT.
Vhite River Basin Coordinating Committee.
vailable from the National Technical Information ervice, Springfield, VA 22161 as AD-A043 948, rice codes: A11 in paper copy, A01 in microfiche. une 1968, 188 p, 18 fig, 40 tab, 2 plates, 12 ttachments.

escriptors: *White River Basin(AR and MO), River basin development, *Agricultural waterneds, *Forest watersheds, *Watersheds, *Planing, *Water resources planning, Regions, Water esources development, Water supply, Water llocation(Policy), River flow, Flow augmentaon, Floods, Water quality, Outdoor recreation, ish and wildlife, Recreation demand, Flood conol, Flood prevention, Economic evaluation, Plan nplementation.

his study was undertaken to determine the shortnd long-term water and related land resource eeds of the White River Basin, an agriculturalural area lying in northeastern and eastern Arkanas and southern Missouri, in order to formulate a omprehensive development plan and recommend hich projects and programs should be initiated in ıe first 10-15 years. Analysis of the Basin included ctors of economic development, current status of esource planning, water resource problems and eeds, plan formulation process, a proposed plan of evelopment, cost considerations, the nature of ocal cooperation in the planning process, and imlementation procedures. Projects and programs onsidered included reservoir sites for flood conol, recreation and hydroelectric power, levees for ood protection and other flood protection measres, and channel improvements. The plan must be exible and should be used as a guide for the development and beneficial use of the water and related land resources of the basin, with each appropriate public agency using the plan to augment its own water planning program. Findings indicate that flood losses in the Basin might be considerable. Water supplies as a whole are adequate, but some areas will suffer water shortages during low flow periods, unless proper facilities are planned and constructed; municipal and industrial water use is projected to increase 6-fold between 1980 and 2020. Pollution is not currently a problem. Hydroelectric power production will increase 7-fold between 1980 and 2020. Outdoor recreation demand will increase rapidly and should be provided for in the proposed plan. It was concluded that the proposed plan would meet the projected needs of the Basin to the year 2020. (Arnold-NC)
W79-04146

COMPREHENSIVE BASIN STUDY: WHITE RIVER BASIN - ARKANSAS AND MISSOURI. VOL. VI: APPENDIX P - PLAN FORMULATION.
White River Basin Coordinating Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 949, Price codes: A18 in paper copy, A01 in microfiche. June 1968, 187 p, 58 tab, 46 plates.

Descriptors: *White River Basin(AR and MO), *River basin development, *Agricultural watersheds, *Forest watersheds, *Watershed management, *Water resources development, *Planning, *Water resources planning, Regions, Water supply, Water allocation(Policy), River flow, Flow augmentation, Floods, Water quality, Water quality control, Irrigation, Outdoor recreation, Fish and wildlife, Flood control, Flood prevention, Economic evaluation, Plan implementation, Hydroelectric power, Navigation.

This study was undertaken to determine the short- and long-term water and related land resource needs of the White River Basin in Arkansas and Missouri. This Appendix details the process of plan formulation for the Basin outlined in Vol. 1: Main Report. The following water resource problems and needs are further delineated: watershed protection, flood control and prevention, drainage, outdoor recreation, fish and wildlife, hydroelectric power, navigation, water supply, water quality control, and irrigation. Planning considerations of control improvements, watershed protection, levee and channel improvement projects, and conservation measures were evaluated in light of their contribution to the overall plan; all four considerations were found not to be entirely independent of each other. Cost-benefit analyses were included where data were available. The Appendix cites the need for planned flood control projects; channelization projects; conservation programs to reduce erosion, surface runoff, and peak flows in the watersheds; and the need for further irrigation projects in the Basin. A detailed discussion is presented of the proposed plan for each of the water resource problems and needs identified in the Basin, including the development of the plan, with programs and projects considered and recommended for implementation in the short-range (10-15 year) plan and the long-range plan; Department of Agriculture plans are discussed as these relate to the plan; and the effects of the 10-15 year plan are presented, along with an economic evaluation of projects in the 10-15 year plan. (Arnold-NC)
W79-04147

MACOMB COUNTY AREA OF PARTICULAR CONCERN INVENTORY.
Southeast Michigan Council of Governments, Detroit.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 392, Price codes: A04 in paper copy, A01 in microfiche. August 1976, NOAA Office of Coastal Zone Management, Washington, D.C., 55 p, 13 ref, 2 append.

Descriptors: *Coasts, *Shores, *Water resources, *Conservation, *Michigan, *Coastal zone management, *Macomb County(MI), *Areas of particular concern, Coastal plains, Resources development, Wetlands, Cities, Urbanization, Floods, Ecology, Land use, Dunes, Erosion, Coastal resources, Lake St Clair(MI), Resource inventory, Residential development.

The purpose of this inventory is to identify critical areas of Macomb County's coastal zone. The critical zone is defined as the U.S. portion of Lake St. Clair, all lands lakeward of the first principal arterial landward of the lake, and those areas further inland tentatively designated by the Federal Insurance Administration as being within the 100-year Great Lakes flood plain. Macomb County encompasses an area of about 481 square miles; Lake St. Clair defines the eastern and southern boundaries of the county, with approximately 29 miles of shoreline. This report discusses the preliminary results of the Macomb County Area of Particular Concern Inventory. The discussion includes a description of the issues and conflicts associated with each category of area of particular concern, in addition to a description of each area nominated. The areas consist of flood hazard areas; wetlands; recreation areas; river mouths and bays; and urban areas. The criteria used in preliminary nomination of areas of particular concern were those set forth by the Michigan Department of Natural Resources. The set of criteria, in addition to data sheets on the areas, are presented in appendices. (Coan-NC)
W79-04148

IRRIGATION MANAGEMENT SERVICE AND MOSQUITO CONTROL,
Colorado State Univ., Fort Collins. Center for Disease Control.
For primary bibliographic entry see Field 3F.
W79-04175

A RECORD OF PALAEODIPTERON WALKERI IDE (DIPTERA: NYMPHOMYIIDAE) FROM MAINE: A SPECIES AND FAMILY NEW TO THE UNITED STATES,
Maine Univ. at Orono. Dept. of Entomology.
T. M. Mingo, and K. E. Gibbs.
Entomology News, Vol. 87, No. 5 and 6, p 184-185, May and June 1976. 3 ref. OWRT A-028-ME(1).

Descriptors: *Entomology, *Insects, *Palaeodipteron walkeri Ide, *Narroguagus River(Maine), Aquatic habitats, Surveys, River flow, Running waters, Currents(Water).

A pair of adult Palaeodipteron walkeri Ide in coupla were collected during the course of a general aquatic survey on the Narraguagus River, Hancock County, Maine, on August 8, 1974. Although the species has been reported in eastern Canada, this represents a first reporting of the species in the U.S. This species belongs to a small family of rare, minute flies which is aquatic in the larval stage and is associated with aquatic mosses; it is both aquatic and aerial in the adult stage. (Davison-IPA)
W79-04265

AQUATIC ENVIRONMENTAL ANALYSIS IN THE LOWER YELLOW-STONE RIVER,
Montana Fish and Game Dept., Helena. Ecological Services Div.
P. J. Graham, and R. F. Penkal.
July 1978. 112 p, 54 fig, 9 tab, 39 ref, 4 append. 6-07-01-10810.

Descriptors: *Aquatic environment, *Fish behavior, *Yellowstone River(Montana), Sauger, Dams, Diversion structure, Turbidity, Migration, Spawning, Hydrologic data, Depth, Water surface profile program, Streamflow.

A study of the potential effects of streamflow alterations on sauger and walleye in the lower Yellowstone River is reported. Movements of these fish were correlated to spawning, feeding, over-wintering and other biological activities, and effects of low dams on their movements were assessed. The walleye moved upstream from the Garrison reservoir to the lowest located diversion,

spawned and returned to the reservoir during spring. There was extensive sauger movement over the lower diversion in the spring, and general upstream movement of mature sauger after spawning. Some sauger and no walleye migrated over the upper diversion where a 0.5 m vertical drop in the river was created. Initial combined spawning criteria for sauger and walleye were determined, and a method for collecting water surface profile data in a large, deep, turbid river was developed. The limitations and potential improvements of data collection and analysis are discussed. (Davison-IPA)
W79-04276

DISINTEGRATION OF A TRADITIONAL RESOURCE-USE COMPLEX: THE OTOMI OF THE MEZQUITAL VALLEY, HIDALGO, MEXICO,
Clark Univ., Worcester, MA.
K. Johnson.
Economic Geography, Vol. 53, No. 4, p 364-367, Oct. 1977. 1 fig, 4 ref.

Descriptors: *Social impact, *Rural sociology, *Economic impact, *Irrigation practices, *Economic feasibility, Water shortage, Terracing, Water harvesting, Salinity, Waterlogging, Arid lands, Agricultural engineering, Crop production, Surface waters, History, Distribution patterns, Mexico.

Since prehistoric times, desert dwellers in the rainshadow of the eastern Sierra Madres have had to devise strategies to enable them to take full advantage of scarce and erratic precipitation. To facilitate the practice of agriculture, these people have constructed walls in gullies and up hillsides in a terrace-like fashion to trap water and soil. Careful construction along with the planting of Maguey (agave sp.) on the field borders for reinforcement, has made it possible for them to live and prosper in this region for centuries. Today, however, the problems threatening the survival of these people are no longer physical but social and economic. The resource base supporting these people has slowly deteriorated as the children have begun to go to school, men seek alternative employment outside the area, and women no longer weave fiber cloth. The expansion of irrigation networks into this area has been a mixed blessing as increasing water supplies have in some communities brought severe salinization and waterlogging. As desertification continues to take a destructive hold upon this region its apparent causes are not predominately physical but rather the social and economic deterioration of indigenous technologies. (Tickes-Arizona)
W79-04293

WATER CONTROL AND DESERTIFICATION, THE RESETTLED NOMADS OF DEH LURAN, IRAN,
Toronto Univ. (Ontario).
For primary bibliographic entry see Field 6A.
W79-04306

THE LEGAL SIGNIFICANCE OF THE LOCAL GOVERNMENT COMPREHENSIVE PLAN,
For primary bibliographic entry see Field 6E.
W79-04420

WATER ALLOCATION: CONSTRAINTS AND OPPORTUNITIES,
For primary bibliographic entry see Field 6E.
W79-04442

7. RESOURCES DATA

7A. Network Design

UPPER TRINITY RIVER BASIN COMPREHENSIVE SEWERAGE PLAN, VOLUME 2: APPENDIX.
Camp, Dresser, and McKee, Boston, MA.
For primary bibliographic entry see Field 5D.
W79-04136

DATA NEEDS IN URBAN HYDROLOGY,
Geological Survey, Portland, OR. Water Resources Div.
D. J. Lystrom.
In: Proceedings of Engineering Foundation Conference on Water Problems of Urbanizing Areas, New England College, Henniker, New Hampshire, July 16-21, 1978. 9 p, 2 fig, 3 tab.

Descriptors: *Urban hydrology, *Urban runoff, *Water quality, *Data collections, *Standards, United States, Planning, Model studies, Hydrologic data, Rainfall-runoff relationships, Data storage and retrieval.

A national urban studies program is being formulated by the U.S. Geological Survey in a cooperative effort with the U.S. Environmental Protection Agency. The data collection aspect of this program is intended for testing and calibration of urban storm-water models. The results of the modeling phase will be used to direct the data collection phase. The objectives for collection of rainfall runoff and quality data are to define urban storm-water problems, to test alternative management techniques and to enhance understanding of the water quantity/quality processes. Proposed guidelines for standardizing data collection on a national basis are presented. (Woodard-USGS)
W79-04409

7B. Data Acquisition

VEGETATIVE COMMUNITIES OF THE GREAT DISMAL SWAMP: IDENTIFICATION AND MAPPING WITH SEASONAL COLOR INFRARED PHOTOGRAPHS,
Geological Survey, Suffolk, VA. Water Resources Div.
P. Gammon
In: Aerial Color Photography in the Plant Sciences and Related Fields; Proceedings of the Sixth Biennial Workshop, Colorado State University, Fort Collins, p 111-131, August 9-11, 1977. 1 fig, 5 tab, 15 ref.

Descriptors: *Remote sensing, *Vegetation, *Swamps, *Aerial photography, *Mapping, Classification, Wetlands, Coastal plains, Virginia, North Carolina, National wildlife refuges, *Great Dismal Swamp.

The Great Dismal Swamp of Virginia-North Carolina is a forested wetland which has been extensively altered by fire, timbering and ditching. Seasonal high- and low-altitude color infrared photographs have been used to identify and map specific swamp vegetative communities. A vegetation map was prepared at a scale of 1:100,000 using a U.S. Geological Survey 7.5-minute orthophotomosaic as the base map. Vegetative cover classes for the Great Dismal Swamp were defined to provide maximum habitat information for management of the swamp by the U.S. Fish and Wildlife Service. These classes are based on dominant canopy species and type and extent of understory. Using these classes in combination resulted in 43 separate canopy designations and 243 specific vegetative communities. Evaluation of class accuracy was accomplished by helicopter overflight using sample sites selected by two methods. A canopy or understory map unit was considered correct if at least one of the classes was identified in the field sample. Using this criterion, canopy accuracy was 93.8% and understory accuracy was 90.5%. (Woodard-USGS)
W79-04018

REMOTE SENSING OF SUBMARINE SPRINGS: FLORIDAN PLATEAU AND JAMAICA, WEST INDIES,
Geological Survey, Woods Hole, MA. Water Resources Div.; National Park Service, San Francisco, CA.; and Geological Survey, Miami, FL. Water Resources Div.
F. A. Kohout, M. C. Kolipinski, and A. L. Higer.
In: Proceedings of the 2nd International Symposium on Ground Water, Palermo, Italy, April 28-May 2, 1973: International Association for Hydraulic Research, p 571-578, 1973. 9 fig, 12 ref.

Descriptors: *Remote sensing, *Submarine springs, *Discharge(Water), *Oceans, *Aerial photography, Coasts, Atlantic Ocean, Thermal water, Water types, Flow, Florida, *Infrared imagery, *Caribbean, *West Indies, Floridan Plateau, Jamaica, Turbidity plumes, Coastal waters.

A change in the turbidity plume formed by a submarine spring located 2.5 miles offshore from Crescent Beach on the northeast coast of Florida suggests that flow from the spring may be decreasing in intensity with time. This decrease may correlate with increased pumpage in the artesian Floridan aquifer which underlies the mainland. In a cooperative project with the United Nations Development Program and the Jamaica Geological Survey Department, the National Aeronautics and Space Administration took more than 17,000 frames of color and infrared color photography of Jamaica and its coastal waters in April 1971. Submarine springs on the north-central coast of Jamaica discharge primarily clear water from karstic limestone and were not discernible in the aerial photos. In contrast, submarine springs on the south coast discharge from sand and gravel aquifers and turbidity plumes are clearly visible in photographs. A significant anomaly was discovered in infrared imagery of the northeast coast of the island after the field investigation was completed. The anomaly is presumed to be evidence of submarine ground-water discharge. (Woodard-USGS)
W79-04020

HISTORICAL PROFILE OF QUALITY OF WATER LABORATORIES AND ACTIVITIES, 1879--1973,
Geological Survey, Reston, VA. Water Resources Div.
W. H. Durum.
Geological Survey open-file report 78-432, 1978. 235 p, 4 fig, 3 tab.

Descriptors: *History, *Water quality, *Laboratories, *United States, Federal government, Laboratory equipment, Chemical analysis, Analytical techniques, Surface waters, Groundwater, Sediment transport, Programs, Budgeting, Costs, Data processing, Publications, *US Geological Survey, *Water Resources Division laboratories, Laboratory locations.

During the period 1918 to 1973 the U.S. Geological Survey, Water Resources Division, established 22 District-type water quality laboratories. These facilities provided the analytical capability and water-quality information for hydrologic investigations and the national baseline inventory of chemical, physical, fluvial sediment, and biological characteristics of surface and ground waters in the United States. Prior to 1950, most methods used in the laboratory were gravimetric, colorimetric, or titrimetric. Flame photometric equipment was common to most laboratories in the 1950's, and the atomic absorption spectrophotometer was added to larger laboratories in the 1960's. In the late 1960's, the first of the automatic analyzers was installed. Total annual production averaged about 480 adjusted complete analyses during the early years 1919-28, about 7,800 in 1946, and about 50,000 in 1970. Budget estimates for the majority of laboratories ranged from $25,000 to $50,000 (1940-50) and $75,000 to $300,000 (1965-73). Beginning in 1972, major functions of the 22 laboratories have been combined into two comprehensive highly-automated facilities located at Denver (Arvada), Colo., and Atlanta (Doraville), Ga. These laboratories comprise the Central Laboratory System for the U.S. Geological Survey. (Woodard-USGS)
W79-04034

USING SATELLITE IMAGERY TO DETECT AND ESTIMATE RAINFALL FROM FLASH-FLOOD PRODUCING THUNDERSTORMS,
National Environmental Satellite Service, Washington, DC. Applications Div.

For primary bibliographic entry see Field 2B.
W79-04072

HYDROLOGIC PARAMETERS FROM LANDSAT IMAGERY FOR WILLIAMS FORK WATERSHED,
Colorado State Univ., Fort Collins. Civil Engr. Dept.
For primary bibliographic entry see Field 5A.
W79-04073

APPLICATION OF A VERSION OF THE STANFORD MODEL TO A SMALL PIEDMONT WATERSHED,
Clemson Univ., SC. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2A.
W79-04086

HYDRAULIC AND ELECTRO-OSMOTIC PERMEABILITY COEFFICIENTS,
Wisconsin Univ. Milwaukee. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W79-04092

UPPER TRINITY RIVER BASIN COMPREHENSIVE SEWERAGE PLAN, VOLUME 2: APPENDIX.
Camp, Dresser, and McKee, Boston, MA.
For primary bibliographic entry see Field 5D.
W79-04136

TENSIOMETERS TEACH HOW TO SAVE FUEL AND WATER,
For primary bibliographic entry see Field 3F.
W79-04165

NEW FLUME BREAKTHROUGH FOR DITCH IRRIGATORS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 3F.
W79-04169

GREENHOUSE EVALUATION OF RESIDUAL PHOSPHATE BY FOUR PHOSPHORUS METHODS IN NEUTRAL AND CALCAREOUS SOILS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04178

DEVELOPMENT OF A DTPA SOIL TEST FOR ZINC, IRON, MANGANESE, AND COPPER,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04179

AN ACOUSTIC PROBE FOR PRECISE DETERMINATION OF DEEP WATER LEVELS IN BOREHOLES,
South Australia Dept. of Agriculture and Fisheries, Adelaide.
G. Schrale, and J. F. Brandwyk.
Ground Water, Vol 17, No 1, p 110-111, January-February 1979. 2 fig, 3 ref.

Descriptors: *Water levels, *Measurement, *Instrumentation, On-site data collections.

An acoustic probe for quick and precise measurement of deep water levels in boreholes is described. The device is lowered with a surveyor's tape and emits a sound when it touches the water surface. The probe consists of a brass cylindrical housing and a carriage accommodating the electronic ports. The materials for the probe cost less than $15.00 (Australian) and it can be assembled in less than 4 hours. (Purdin-NWWA)
W79-04241

CHANNEL EROSION SURVEYS ALONG THE TAPS ROUTE, ALASKA 1977,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2J.
W79-04411

WATER SAMPLING BUCKET,
T. Zubricki.
U.S. Patent No. 4,122,721, 4 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1760, October 31, 1978.

Descriptors: *Patents, *Sampling, *Water sampling, Temperature, Salinity, Instrumentation, Thermometers.

A water sampling bucket for use in determining water surface temperature and salinity in the ocean has a thermometer supported at one end within a rubber grommet. The mercury bulb end is submerged in a water sampling portion which is clear plastic where the temperature markings occur. The sampler contains an opening at its bottom end for receiving sampled water, and encompasses the lower end of the thermometer which is coated with a heavy impact resistant material. The object of the invention is to provide a readily submersible water sampling bucket which does not change temperature for extended periods of time, once in the air and/or exposed to direct sun. (Sinha-OEIS)
W79-04459

7C. Evaluation, Processing and Publication

GREEN RIVER BASIN SYSTEMS MODELS - DEVELOPMENT OF SIX-HOUR FLOW RECORDS,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04008

GREEN RIVER DATA BASE SYSTEM,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04009

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1977--VOLUME 2. UPPER MISSISSIPPI AND MISSOURI RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Geological Survey Water-Data Report MN-77-2, September 1978. 426 p, 3 fig.

Descriptors: *Minnesota, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Upper Mississippi River basin, *Missouri River basin.

Water resources data for the 1977 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the Upper Mississippi and Missouri River basins and contains discharge records for 66 gaging stations; stage and contents for 9 lakes and reservoirs; water quality for 36 gaging stations, 5 partial-record flow stations, 27 lakes, and 15 wells; and water levels for 93 observation wells. Also included are 102 crest-stage partial-record stations and 64 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (Woodard-USGS)
W79-04023

LIMNOLOGICAL CHARACTERISTICS OF CYPRESS LAKE, UPPER KISSIMMEE RIVER BASIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2H.
W79-04025

HYDROLOGIC DATA FOR SOLDIER CREEK BASIN, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
W. J. Carswell, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 740, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-87, July 1978. 26 p, 1 fig, 1 tab, 6 ref.

Descriptors: *Hydrologic data, *Computer programs, *Data collections, *Methodology, *Watersheds(Basins), Rainfall, Streamflow, Sediment transport, Observation wells, Water levels, Water quality, Kansas, *Soldier Creek basin, *Magnetic tape.

Selected hydrologic data collected in the Soldier Creek basin in northeastern Kansas are available on magnetic tape in card-image format. Data on the tape include water discharge in fifteen-minute and daily time intervals; rainfall in fifteen-minute and daily time intervals; concentrations and particle sizes of suspended sediment; particle sizes of bed material; ground-water levels; and chemical quality of water in concentrations of selected constituents. The data-collection system includes: (1) 7 recording streamflow stations; (2) 5 recording rainfall stations; (3) 51 nonrecording rainfall stations located within and adjacent to the basin; (4) 31 ground-water observation wells (two recording); and (5) intermittent chemical quality of water and sediment sampling sites. Examples of the information on magnetic tape for each type of data collected are presented in computer-printout format. (Woodard-USGS)
W79-04026

WATER IN THE SKAGIT RIVER BASIN, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost, and R. E. Lombard.
Washington Department of Ecology Water-Supply Bulletin 47, 1978. 247 p, 20 fig, 2 plates, 11 tab, 43 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Precipitation(Atmospheric), *Melt water, Water supply, Glaciers, Available water, Water demand, Water utilization, Water quality, Land use, Water temperature, Floods, Low flow, Hydrologic budget, *Washington, *Skagit River basin, North Cascades.

The 2,730-square-mile Skagit River basin in Washington is largely mountainous and contains 396 glaciers that cover nearly 65 square miles, the largest volume of snow and ice storage in a single basin within the conterminous United States. Precipitation averages about 100 inches annually over the basin, and ranges from about 25 inches in the western lowland to about 190 inches in higher parts of the Cascade Range, in the basin's upper reaches. Altitudes range from sea level at the Skagit River delta on the west to 10,773-foot Mt. Baker. Glacial and snowmelt waters provide sustained year-around streamflows in all major streams. This assures an abundant water supply for present and projected water uses in the basin including irrigation, industrial use, commercial and domestic supplies, lumbering, fishing, recreation, and hydroelectric power generation. Five major dams provide storage for power generation, flood control, and recreational use. Ground-water supplies are obtained principally from sand and gravel in valley alluvium, mostly in the lower Skagit River valley. Both surface and ground water are of good to excellent quality for most uses, although excessive concentrations of iron and extreme hard-

ness were found locally in ground water. (Woodard-USGS)
W79-04028

WATER RESOURCES DATA FOR ALASKA, WATER YEAR 1977.
Geological Survey, Anchorage, AK. Water Resources Div.
Geological Survey Water-Data Report AK-77-1, November 1978. 439 p, 11 fig.

Descriptors: *Alaska, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Alaska consist of records of stage, discharge, and water quality of streams; stage and water quality of lakes; and water levels and water quality in wells and springs. This report contains discharge records for 112 gaging stations, stage only records for 4 gaging stations, water quality for 60 stations, and water levels for 25 observation wells. Also included are 18 low-flow, 91 crest-stage, and 19 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements of discharge, lake stage, or water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alaska. (Woodard-USGS)
W79-04032

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1977--VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Geological Survey Water-Data Report MN-77-1, September 1978. 276 p, 2 fig.

Descriptors: *Minnesota, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Great Lakes, *Tributaries to Lake Superior, *Souris-Red-Rainy River basins.

Water resources data for the 1977 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the Great Lakes and Souris-Red-Rainy River basins and contains discharge records for 79 gaging stations; stage only records for 1 gaging station; stage and contents for 4 lakes and reservoirs; water quality for 21 gaging stations, 2 partial-record flow stations, 4 lakes, and 65 wells; and water levels for 18 observation wells. Also included are 39 crest-stage partial-record stations and 35 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (Woodard-USGS)
W79-04036

COMPUTER PROGRAMS IN WATER RESOURCES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Chung Sang Chu, and C. E. Bowers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 885, Price codes: A13 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota, Bulletin 97. November 1977. 263 p. OWRT C-5111(No. 4227)(1), 14-31-001-4227.

Descriptors: *Computer programs, *Simulation models, *Simulation analysis, Water resources, Model studies, Information exchange, Reviews, Bibliographies.

The study is concerned with the many computer programs and simulation models in the field of water resources. The report consists of three parts. The first is a brief summary of information in this field and the sources of special interest. The second is a fairly detailed review of 28 programs of special interest and a brief review of 8 books in the same category. The third section is an annotated bibliography of about 390 computer programs and simulation models. (Waelti-Minn)
W79-04081

DETERMINATION OF THE TECHNICAL POTENTIAL OF THE LIME-MAGNESIUM CARBONATE PROCESS, VOLUME I,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 3A.
W79-04161

FORTRAN IV PROGRAM TO COMPUTE DIVERSITY INDICES FROM INFORMATION THEORY,
Kansas Univ., Lawrence. Dept. of Geology.
For primary bibliographic entry see Field 10D.
W79-04262

FORTRAN IV PROGRAM TO COMPUTE REPLICATED DIVERSITY INDICES FOR RANDOM SAMPLES OF SPECIFIED SIZE,
Kansas Univ., Lawrence. Dept. of Geology.
For primary bibliographic entry see Field 10D.
W79-04263

FORTRAN IV PROGRAM TO COMPUTE HIERARCHICAL DIVERSITY,
Kansas Univ., Lawrence. Dept. of Geology.
For primary bibliographic entry see Field 10D.
W79-04264

THE DYNAMICS OF THE COASTAL BOUNDARY WATERS OFFSHORE SOUTHERN NEW JERSEY,
Pandullo Quirk Associates, Wayne, NJ.
For primary bibliographic entry see Field 2L.
W79-04360

SOME PRACTICAL TECHNIQUES OF TWO-DIMENSIONAL INTERPOLATION IN COMPUTATIONAL HYDRAULICS,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 8B.
W79-04368

ON NUMERICAL ACCURACY IN COMPUTATIONAL HYDRAULICS,
Texas A and M Univ., College Station. Dept. of Civil and Ocean Engineering.
For primary bibliographic entry see Field 8B.
W79-04369

EVALUATION OF A BARRIER AGAINST SEAWATER INTRUSION,
Los Angeles County Flood Control District, CA.
For primary bibliographic entry see Field 2L.
W79-04370

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1977--VOLUME 2. PACIFIC SLOPE BASINS FROM ARROYO GRANDE TO OREGON STATE LINE EXCEPT CENTRAL VALLEY.
Geological Survey, Menlo Park, CA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 895, Price codes: A24 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CA-77-2, September 1978. 544 p, 3 fig, 1 tab.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Pacific slope basins.

Volume 2 of water resources data for the 1977 water year for California consists of records of stage, discharge, and water quality of streams and wells; stage, contents, and water quality in lakes and reservoirs; and water levels in wells. This report contains discharge records for 164 gaging stations; stage and contents for 20 lakes and reservoirs; water quality for 195 stations and 16 wells; and water levels for 24 observation wells. Also included are 13 crest-stage partial-record stations and 139 low-flow partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (Woodard-USGS)
W79-04394

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1977--VOLUME 3. SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER.
Geological Survey, Menlo Park, CA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 630, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CA-77-3, September 1978. 379 p, 12 fig, 1 tab.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Great Basin, *Walker River, *Truckee River, *Southern central valley basins.

Volume 3 of water resources data for the 1977 water year for California consists of records of stage, discharge, gage-height, and water quality of streams; stage contents, and water quality in lakes and reservoirs; and water levels in wells. This report contains discharge records for 180 gaging stations, stage and contents for 42 lakes and reservoirs, gage-height records for 2 lakes, and water quality for 47 stations, and water levels for 12 observation wells. Also included are 34 crest-stage partial-record stations, 35 low-flow partial-record stations, and 4 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as special investigations and miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (Woodard-USGS)
W79-04395

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1977--VOLUME 1. COLORADO RIVER BASIN, SOUTHERN GREAT BASIN FROM MEXICAN BORDER TO MONO LAKE BASIN, AND PACIFIC SLOPE BASINS FROM TIJUANA RIVER TO SANTA MARIA RIVER.
Geological Survey, Menlo Park CA. Water Resources Div.
Geological Survey Water-Data Report CA-77-1, November 1978. 638 p, 6 fig, 1 tab.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Colorado

River basin, *Southern Great Basin, *Pacific slope basins.

Volume 1 of water resources data for the 1977 water year for California consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality in lakes and reservoirs; and water levels in wells in southern California. This report contains discharge records for 234 gaging stations, stage-only record for 3 gaging stations, stage and contents for 18 lakes and reservoirs, water quality for 72 stations and 2 wells, and water levels for 21 observation wells. Also included are 13 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (Woodard-USGS)
W79-04397

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1977--VOLUME 4. NORTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE.
Geological Survey, Menlo Park, CA. Water Resources Div.
Geological Survey Water-Data Report CA-77-4, October 1978. 425 p, 12 fig, 1 tab.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Northern central valley basins, *Sacramento River basin.

Volume 4 of the water resources data for the 1977 water year for California includes basins in the northern part of the State. This volume contains discharge records for 189 gaging stations, stage and contents for 31 lakes and reservoirs, precipitation data for 2 stations, water quality for 74 stations, and water levels for 3 observation wells. Also included are 23 crest-stage partial-record stations, 36 low-flow partial-record stations, and 7 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as special investigations and miscellaneous measurements. These data represent that part of the National Water Data system operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (Woodard-USGS)
W79-04398

INDEX TO WATER-RESOURCES DATA FOR LOUISIANA, GROUND-WATER RECORDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
S. L. Marshall.
Louisiana Department of Public Works Water Resources Basic Records Report No 9, 1978. 176 p, 75 fig, 3 tab, 15 ref.

Descriptors: *Indexing, *Water wells, *Water levels, *Water quality, *Louisiana, Groundwater, Observation wells, Well data, Aquifers, Maps, Wells, Sites.

This index is a listing of water wells, active and inactive, for which water-level and (or) water-quality data have been collected periodically and maintained by the U.S. Geological Survey in Louisiana. The listing is presented in tabular format and provides the station identification number, location, owner, depth, geohydrologic unit, type of data, current status or frequency, and period of record for 3,177 wells. Of these, about 780 wells form the basic network of the Geological Survey's current data-collection program. (Woodard-USGS)
W79-04412

8. ENGINEERING WORKS

8A. Structures

ELECTRIC POWER DEVELOPMENT IN THE PACIFIC NORTHWEST REGION: INSTITUTIONAL COMMITMENTS AND ALTERNATIVES, PHASE 2,
Washington Univ., Seattle. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6E.
W79-04159

IRRIGATION PIEP REPAIR CUTS COSTS,
R. Larsen.
Irrigation Age, Vol. 12, No. 7, p 6, April, 1978. 1 fig.

Descriptors: *Pipes, Repairing, *Costs, Colorado, *Equipment, Maintenance, Irrigation.

The experience of a Colorado farmer who designed a repair operation for damaged aluminum irrigation pipes was discussed. Repairing damaged pipes has proved to be considerably cost-effective in comparison to the costs for new pipes. (Skogerboe-Colorado State)
W79-04185

DRAIN-HOLE DRILLING CAN INCREASE PRODUCTIVITY,
EG and G Idaho, Inc., Idaho Falls.
S. M. Prestwich, and L. G. Miller.
World Oil, Vol. 187, No. 7, December 1978, p 69-71. 4 fig.

Descriptors: *Drilling, *Geothermal studies, *Deep wells, *Well production, Directional drilling, Cost-benefit analysis.

This paper describes one of the techniques used by the Raft River Geothermal Exploration (RRGE) project to decrease hot water production costs. A deep geothermal well was completed with three directionally drilled legs, or drain-holes. The two extra legs improved the well's production by 500%, from an initial rate of 80 gpm to 425 gpm. This fivefold increase in production was purchased for only 20% increase in drilling cost. Orientation of the directional string was achieved with a wireless orientation indicator with surface readout. Due to the high temperature in the legs (305 degrees F), rubber parts of the mud motor disintegrated. This problem may be avoided by using a high-temperature turbo-drill. It was found that increased production depends more on fracturing than on permeability or porosity. This technique will be used production wells and injection wells and will improve the overall economics of generating electricity using geothermal energy. (Purdin-NWWA)
W79-04249

WATER SYSTEM DESIGN FOR A LOW YIELD WELL,
Hanson Drilling Co., Inc., Vancouver, WA.
M. Sample.
Water Well Journal, Vol. 33, No. 1, p 41, January 1979. 1 fig.

Descriptors: *Water supply, *Water storage, *Water yield, Storage tanks, Pumps.

The design of an individual water supply system for a low yield well is presented. The key components of the system are a 1200 gallon reserve tank and a small pump to transfer water from the reserve tank to the storage tank. The additional cost of this system would vary depending on location and area, but it is approximately $1,000. A well with only one-half gpm yield would meet the normal daily domestic water requirement with 120 gallons to spare. (Purdin-NWWA)
W79-04250

BLASTING-IT TURNS DRY HOLES INTO WET ONES,
Universal Oil Products, St. Paul, MN. Johnson Div.
F. Driscoll.
The Johnson Drillers Journal, Vol. 50, No. 6, p 1-3, 13, November-December 1978.

Descriptors: *Drilling, *Explosives, *Well development, Water wells, Dry wells, Till, Crystalline rocks, Joints(Geologic), Fracture permeability.

Methods and tools for drilling wells faster and obtaining better yields in an area of crystalline rock overlain by bouldery till are described. Salvaging of dry wells in this area requires widening of horizontal joint systems so that they intercept vertical faults. The cost of hydraulic fracturing is prohibitive, but an inexpensive and effective method is the use of explosives. To maximize the blast effect in a horizontal direction, sand in used to cover the explosives. The sand also props open joints after the explosives. (Purdin-NWWA)
W79-04251

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME ONE: DESIGN DATA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
August 1977. 175 p, 41 fig, 6 tab, 42 ref, 15 append.

Descriptors: *Dams, *Dam design, *Damsites, Dam foundations, Concrete dams, Concrete technology, Aggregates, Pozzolans, Concrete additives, Foundations, Design considerations, Hydrologic data, Climatic data, Foundation testing, Placer County(California).

Background, general information, and the design data upon which Auburn Dam was based are presented in this first volume of a five volume series. Information is provided on: climatological data, hydrologic data, reservoir capacity and operation, site selection, and construction materials. Details of the in situ and laboratory tests used to investigate the foundation at Auburn are reviewed. Test procedures are described, and sample results are presented. The discussion on concrete properties includes a description of the preparation and testing of concrete samples from various combinations of the actual cements, pozzolans, water, and aggregates to be used in the dam and foundation. (See W79-04269 thru W79-04274) (Davison-IPA)
W79-04268

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME TWO: FOUNDATION STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
May 1978. 198 p, 48 fig, 7 tab, 16 ref, 9 append.

Descriptors: *Dams, *Dam foundations, *Foundation investigations, Stability, Finite element analysis, Analytical techniques, Slope stability, Shear, Rock properties, Safety factors, Structural stability.

The foundation analyses and treatment of Auburn Dam for both deformation and stability purposes are presented in this second volume of a five volume series. The properties of continuous shears and the effective modulus of rock masses are discussed. The Joint-shear index and the Shear catalog, two new techniques developed by the Bureau of Reclamation for determining the effective modulus, were used with conventional two-dimensional finite element programs to model the foundation characteristics and behavior under anticipated dam and reservoir loads. The foundation treatment was determined based on these deformation studies. The general procedure and the explorations and studies performed to determine modes for stability analysis are described; four stability modes are discussed. The methods of analysis to be used are presented, and the critical properties of

strength and continuity are determined. (See also W79-04268) (Davison-IPA)
W79-04269

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME THREE: STATIC STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
November 1977. 193 p, 111 fig, 18 ref.

Descriptors: *Concrete dams, *Arch dams, *Design criteria, *Design specifications, *Dam design, Stress analysis, Structural design, Structural analysis, Mathematical studies, Finite element analysis.

The structural design and static analysis of Auburn Dam are discussed in the third volume of a five volume series. A general discussion of the various types of dams, the advantages and disadvantages of each, and the reasons for the selection of a concrete double curvature arch dam is followed by an outline of the overall process of concrete arch dam design and layout. The final design for Auburn Dam is presented and the criteria applied to the design is discussed along with additional data which was not presented in Volume I, Design Data. The six different mathematical and physical model analyses used to study the stresses in the dam are examined, and the results are compared and evaluated with regard to the design criteria. (See also W79-04268) (Davison-IPA)
W79-04270

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME FOUR: DYNAMIC STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
April 1978. 104 p, 46 fig, 4 tab, 60 ref.

Descriptors: *Earthquake engineering, *Seismic design, *Structural design, *Design criteria, Concrete dams, *Dam design, Structural stability, Safety factors, Arch dams, Dynamics, Seismic studies, Stress analysis, Structural analysis.

The details and results of six dynamic studies performed for the Auburn Dam are reported in the fourth volume of a five volume series on the Auburn Dam. Selected natural or artificially generated earthquake accelerations were mathematically applied to the dam structure as statically designed. Three earthquakes, the Operating Basis Earthquake, the Design Basis Earthquake, and the Maximum Credible Earthquake, are defined, and the allowable structural response to each is discussed. Specific loading criteria, the specific earthquake studies for the Auburn site and their response spectra and accelerograms are examined. Thrust block and water barrier, the methods of analysis used in the dam studies are described. The results of the six studies are tabulated and significant stresses at different locations in the dam are considered. These results are compared and the significance of specific stresses to the dynamic performance of the dam are evaluated. (See W79-04268) (Davison-IPA)
W79-04271

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME FOUR SUPPLEMENT: DYNAMIC STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
November 1977. 450 p.

Descriptors: *Concrete dams, *Arch dams, *Data collections, Structural design, Safety factors, Curves, Analytical techniques, Auburn Dam, Placer County(California), Loads(Forces), Earthquake engineering, Seismic design.

Part of the computer results for the six dynamic studies made for Auburn Dam and normalized model displacement curves for 30 modes determined at four elevations throughout the dam are presented in this supplement to Volume IV of a series on Auburn Dam. (See also W79-04268) (Davison-IPA)
W79-04272

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME FOUR APPENDICES: DYNAMIC STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
November 1977. 369 p, 2 append.

Descriptors: Concrete dams, *Arch dams, *Stress analysis, Data collections, Structural analysis, Seismic design, Earthquake engineering, Loads(forces), Dams, Dam design.

Appendices A and B to Volume IV, Dynamic Studies, of a series on Auburn Dam are presented. Appendix A consists of principal stress plots for the six dynamic studies conducted, and Appendix B contains element stress histories for five of the six studies. (See also W79-04268)
W79-04273

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME FIVE: SUMMARY AND CONCLUSIONS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
June 1978. 31 p, 5 fig.

Descriptors: *Concrete dams, *Arch dams, *Auburn Dam, Design data, Dam sites, Dam foundations, Earthquakes, Seismic design, Foundation investigations, Construction materials, Stress analysis, Loads(Force), Analytical techniques.

An executive summary of the preceeding four volumes on the Design and Analysis of Auburn Dam is presented. Each chapter in this volume corresponds to the other volumes in the series, and presents the significant conclusions of each. The contents of the preceding volumes are listed. (See also W79-04268)(Davison-IPA)
W79-04274

THE CAP - AN ENGINEERING MARVEL,
Arizona Society of Professional Engineers, Phoenix.
R. Johnson.
Arizona Professional Engineer, Vol. 30, No. 7, p 8-9, July 1978. 3 fig.

Descriptors: *Canal construction, *Canal design, *Central Arizona Project, *Water conveyance, Water management(Applied), Arizona.

With water deliveries scheduled to begin in the mid 1980's, the Central Arizona Project (CAP) is coming closer to reality every day. Aspects of the design and construction of the canal are described here to illustrate that this system is not only an engineering marvel but also a tribute to Arizonans who refused to give up the fight for better management and conservation of their state's meager water resources. Although the construction materials and installation equipment represent the peak of modern scientific achievement, the most obvious evidence of technological progress is the canal itself. With 90 miles already completed, work is now concentrating on the Granite Reef segment of this canal which will eventually stretch from Lake Havasu at Parker Dam to Tucson, a distance of approximately 300 miles. The history, construction and design criteria of this engineering marvel which will carry 2.2 million acre feet of water are described while illustrating the critical water problem that will be greatly alleviated upon completion of the system in mid 1980's. (Tickes-Arizona)
W79-04294

SPILLWAY STILLING BASIN FOR LOW FROUDE FLOWS,
Bureau of Reclamation, Denver, CO.
For primary bibliographic entry see Field 8B.
W79-04355

FLOW PATTERNS AROUND SUBMERGED INTAKE STRUCTURES FOR POWER PLANTS,
United Engineers and Constructors, Inc., Philadelphia, PA. Hydraulics Group.
K. S. Satija, and Y. B. Dai.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Specialty Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 37-57, 1977. 6 fig, 3 ref.

Descriptors: *Intakes structures, *Flow, *Model studies, *Hydraulic structures, Mathematical models, Hydraulic models, Distribution patterns, Spatial distribution, Currents(Water), Theoretical analysis, Analytical techniques, Potential flow.

In order to investigate the velocity field around the intake structures, a theoretical study was initiated based on the theory of potential flow of sinks and method of images. In this study, each intake was simulated as a circular line sink with a diameter equal to that of the intake head. The computer program POTVEL-II was developed for calculating the values of potential functions at any desired point around the intakes, and the equipotential lines can be drawn from them. Based on these lines, the streamlines can be plotted considering that streamlines are orthogonal to equipotential lines and form a network pattern. By virtue of these lines, flow net in the flow field near the intakes can be constructed. The magnitude and directions of velocity at any desired point in the flow field can be determined thereafter. Hydraulic model tests also were conducted for an intake structure. The results obtained from the analytical model and the physical model agree fairly well. It was concluded that the analytical model POTVEL-II is a competent tool to predict the velocity distribution around the intake structures. (See also W79-04351) (Humphreys-ISWS)
W79-04356

INTAKE SCREENWELL SURGING CAUSED BY WAVE DYNAMICS,
Stone and Webster Engineering Corp., Boston, MA.
Y. J. Tsai, Y. C. Chang, and D. M. Crocker.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 58-65, 1977. 5 fig, 3 ref.

Descriptors: *Waves(Water), *Surges, *Intakes structures, *Model studies, Dynamics, Fluid mechanics, Analytical techniques, Analysis, Mathematical models, Equations, Unsteady flow, Coastal structures.

An intake screenwall surge mathematical model was developed for an intake chamber both directly leading to the open water and indirectly leading to the open water through a certain length of conduit Continuity and momentum equations were solved for the water body in the intake system. Special considerations were given to the vertical acceleration of water column and the wave characteristics at the opening of the intake structure. The energy flux of inletting water and the maximum interior flood level are functions of the opening dimension, size of the chamber, submergence of the opening, length of the connecting conduit, and the design wave characteristics. Intake chambers subject to surging to floor levels must have analyses to verify adequacy of venting. (See also W79-04351)(Humphreys-ISWS)
W79-04357

POWER GENERATION AND POTABLE WATER RECOVERY FROM SALINOUS WATER,
Universal Oil Products Co., Des Plaines, IL. (Assignee).
For primary bibliographic entry see Field 3A.
W79-04468

8B. Hydraulics

GREEN RIVER BASIN SYSTEMS MODELS - DEVELOPMENT OF SIX-HOUR FLOW RECORDS,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04008

GREEN RIVER DATA BASE SYSTEM,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04009

THE EFFECTS OF UNSTEADY POTENTIAL FLOW ON HEATED LAMINAR BOUNDARY LAYERS IN WATER: FLOW PROPERTIES AND STABILITY,
Rand Corp., Santa Monica, CA.
W. S. King, J. Aroesty, L. S. Yao, and W. Matyskiela.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 711, Price codes: A03 in paper copy, A01 in microfiche. Report No. R-2164-ARPA, November 1977. 28 p, 6 fig, 2 tab, 15 ref. DAHC15-73-C-0181.

Descriptors: *Boundary layers, *Stability, *Theoretical analysis, *Laminar flow, *Unsteady flow, Fluid mechanics, Analysis, Heated water, Equations, Reynolds number, Laminar boundary layers, Differential equations.

The effects of unsteadiness and the stability of boundary-layer flows as governed by the Orr-Sommerfeld equation were discussed. The condition required for validity of the quasi-steady approximation of governing flow equations is that the ratio of diffusion time to flow time should be small. It also was shown that criteria for validity of the quasi-steady approximation of the Orr-Sommerfeld equation are based on modifications of this ratio and are not nearly as stringent. Examples of heated wedge flows in water that were presented and discussed showed the profound effect of even slowly varying unsteadiness on both laminar boundary-layer flow and its stability. (Adams-ISWS)
W79-04046

SELECTIVE WITHDRAWAL FROM TWO-LAYER FLUID,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
I. R. Wood.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14263, p 1647-1659, December 1978. 7 fig, 14 ref, 2 append.

Descriptors: *Discharge(Water), *Cooling water, *Withdrawl, Laboratory tests, Fluid mechanics, Hydraulics, Reservoirs, Stratified flow, Stratification, Flow, Velocity, Theoretical analysis, Thermal stratification, Civil engineering, Cooling ponds.

The discharge from a stably stratified reservoir is set by a valve, but the quality of the water and the flow pattern near the valve is determined by the interaction of the stratification and the geometry of the reservoir. In a two-layered system, this control is at a single section. In previous work in this area, the gradually varied flow assumption was made. In this paper it was shown that an alternative assumption, i.e., at the critical section (the virtual control) the velocity field in each layer is radial, with velocities in each layer that are only functions of the radial distance, yields a simple theory. This theory gives, for a particular discharge and given upstream conditions, the ratio of the discharge from each layer. It is applicable to the practical cases where the flow is not gradually varied. Experimental results were presented which support the theory. (Sims-ISWS)
W79-04123

SPILLWAY STILLING BASIN FOR LOW FROUDE FLOWS,
Bureau of Reclamation, Denver, CO.
R. L. George.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 28-36, 1977. 5 fig, 5 ref.

Descriptors: *Energy dissipation, *Spillways, *Hydraulic models, *Hydraulic design, Froude number, Hydraulic structures, Hydraulics, Laboratory tests, Basins, Design criteria, Flow characteristics, Analysis, Hydraulic jump.

Limited water supplies are currently available in most coastal areas to meet municipal and industrial demands. As these areas continue to grow, additional water supplies must be developed to meet their needs. Diversion structures and low head dams will be built as part of these expanded water supplies. Typically, these structures are comparatively low and their spillways will operate at low Froude numbers. Palmetto Bend Dam stilling basin is an example of a low Froude number structure modeled recently in the Bureau of Reclamation Hydraulic Laboratory, and the recommended design is quite different from available low Froude number designs. As a result, hydraulic model investigations were performed to develop a design that would be suitable for a low Froude number stilling basin. The design developed during these studies usually will be adequate without model tests, unless approach or outlet flow is asymmetrical or unless testing is needed to develop a smaller stilling basin. Some of the criteria developed from this model study were location, size and type of baffle piers, chute blocks, end sills, length of the basin, and tailwater depth. The above criteria and guidelines from previous studies were combined to formulate the design guidelines recommended for the low Froude number hydraulic jump stilling basin. (See also W79-04351) (Humphreys-ISWS)
W79-04355

FLOW PATTERNS AROUND SUBMERGED INTAKE STRUCTURES FOR POWER PLANTS,
United Engineers and Constructors, Inc., Philadelphia, PA. Hydraulics Group.
For primary bibliographic entry see Field 8A.
W79-04356

IMPROVED DRAG FORCE LINEARIZATIONS FOR STRUCTURAL DYNAMIC CALCULATIONS,
McDermott (J. Ray) Co., Inc., New Orleans, LA.
M. J. Mes.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 66-72, 1977. 1 fig, 2 ref.

Descriptors: *Drag, *Mathematical models, *Hydraulic structures, *Wave(Water), Coastal structures, Model studies, Analytical techniques, Dynamics, Loads(Forces), Analysis, Frequency analysis, Fourier analysis, Spectral density function.

In the non-deterministic dynamic analysis of offshore structures, the drag force is linearized. This is necessary because if otherwise, calculation methods from the field of spectral statistics cannot be applied to obtain calculation results. Present linearization procedures ignore higher frequency force harmonics produced by the regular drag force. These are important because these higher frequencies can cause resonant motion of deep water structures. A new linearization procedure was presented (based on a Fourier expansion) which causes the higher force frequencies to be included in the structural dynamic calculations. (See also W79-04351)(Humphreys-ISWS)
W79-04358

MINIMIZING WAVE TRANSMISSION THROUGH JETTIED INLETS,
Worcester Polytechnic Inst., Holden, MA. Alden Research Lab.
For primary bibliographic entry see Field 2H.
W79-04363

SOME PRACTICAL TECHNIQUES OF TWO-DIMENSIONAL INTERPOLATION IN COMPUTATIONAL HYDRAULICS,
Geological Survey, Reston, VA.
C. Lai.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 169-178, 1977. 4 fig, 7 ref.

Descriptors: *Hydraulics, *Numerical analysis, *Analytical techniques, *Mathematical studies, Approximation method, Flow, Model studies, Equations, Computer models, Two-dimensional flow, Method of characteristics, Finite difference analysis.

The numerical simulation of hydraulic problems often requires the use of various interpolation techniques. An interpolation can be achieved by finding a curve (surface) that represents the given data points, approximating the curve (surface) by function(s), and finally evaluating the function value at a desired point (interpolation point). In this paper, applications of a few truncated forms of the two-dimensional (2-D) Taylor series to interpolation of both function values and function derivatives in some x-y grid systems were shown. Various schemes were developed subsequently for interior points, edge points, and salient and reentrant corner points of a schematized 2-D flow region. Numerical experiments and applications have shown favorable results, indicating that further exploration is worthwhile. There remains plenty of room for improvement in interpolation in computational hydraulics. Other techniques, such as bicubic spline functions, also must be investigated. Furthermore, sound engineering judgment must always be used in performing such interpolation. (See also W79-04351)(Humphreys-ISWS)
W79-04368

ON NUMERICAL ACCURACY IN COMPUTATIONAL HYDRAULICS,
Texas A and M Univ., College Station. Dept. of Civil and Ocean Engineering.
D. R. Basco.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 179-186, 1977. 3 fig, 10 ref, 2 append.

Descriptors: *Hydraulics, *Numerical analysis, *Analytical techniques, *Mathematical studies, Approximate method, Estimating, Analysis, Methodology, Flow, Equations, Calibrations, Finite differences analysis.

Finite-difference methods remain a popular and powerful technique to solve numerically the fundamental flow equations of hydraulics on the computer. Because all numerical methods are approximations, the question of relative inaccuracies resulting from the machine computations must be considered. Fortunately, theoretical methods do exist to estimate the amplitude and phase errors that occur in the propagation problems of engineering concern, e.g., river flooding routing, tidal hydraulics, etc. The purposes of this paper were

(1) to review these methods, (2) to show how the calculations can be readily made for any finite-difference scheme, and (3) to discuss their implications when applied to engineering and research problems. A recipe can be written for any scheme so that accuracy portraits (both amplitude and phase) can be computed easily. Although not exact, these portraits give insight into the proper grid and time spacings to employ, into whether implicit schemes are worthwhile, and other factors to insure a desired accuracy in the computations. For simulation and modeling applications, these concepts will permit more physically realistic calibration and verification phases of the prototype. (See also W79-04351) (Humphreys-ISWS)
W79-04369

THE STABILITY OF A TWO LAYER FLOW WITHOUT SHEAR IN THE PRESENCE OF BOUNDARY GENERATED TURBULENCE: FIELD VERIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
S. C. McCutcheon, and R. H. French.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 212-219, 1977. 3 fig, 2 tab, 9 ref.

Descriptors: *Stratified flow, *Flow profiles, *On-site investigations, *Boundary processes, Interfaces, Turbulent flow, On-site data collections, Analytical techniques, Analysis, Density currents, Density stratification, Velocity, Mixing, Flow, Flow stability, Shear velocity, Layered flow.

It was the purpose of this paper to examine the question of interfacial stability in the presence of boundary generated turbulence and to present field data which verify previous laboratory experiments. Field measurements were made downstream of the Cumberland Steam Plant near Cumberland City, Tennessee, over a period of 8 months. Previous studies of thermal plumes at Widows Creek, John Sevier, and New Johnsonville Steam Plants yielded additional data. Conclusions drawn for the field and laboratory data were: (1) although the plotted field and laboratory data do not overlap, there is a consistency between the respective flow regions of stable, transitional and unstable flow; (2) the field data lie in bands with the position of the band determined by the value of the parameter (shear velocity)/(average velocity). The value of this parameter increases from left to right. In general, these bands slope upward from left to right. Within a band, the Reynolds Number varies only slightly, but the change in density (delta rho) increases from left to right. Thus, it seems that for a given value of (shear velocity)/(average velocity), delta rho can be increased to such a level that the turbulent eddies cannot overcome the stratification and the interface is stable. It was suggested that since the results were not conclusive, future investigations should be controlled laboratory experiments where (shear velocity)/(average velocity) can be varied over a wide range. (See also W79-08140)and W79-04351) (Humphreys-ISWS)
W79-04372

MODIFICATION OF THE CHEZY ROUGHNESS COEFFICIENT BY DENSITY STRATIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
R. H. French.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 220-227, 1977. 5 fig, 1 tab, 5 ref.

Descriptors: *Stratified flow, *Roughness coefficient, *Open channel flow, *Density stratification, Chezy equation, Hydraulics, Flow, Roughness(Hydraulics), Theoretical analysis, Analytical techniques, Flow characteristics, Mathematical models.

Basic to all analysis of open channel flow, steady or unsteady, is the necessity of computing the losses due to shear at the boundaries. In the past, this has been done by estimating the Chezy roughness coefficient, C, and using the Chezy uniform flow equation. Recent theoretical and experimental work by the author indicated that in a stratified flow, C is not only a function of the Reynolds number and the boundary roughness, but also a function of the density gradient. It should be noted that the experiments discussed were neither designed nor intended to verify the theoretical analysis; however, they do serve for initial verification. From the hypotheses and experimental data discussed, it is clear that density stratification can modify significantly the value of the Chezy roughness coefficient. In many cases, a simple linearization of the density gradient may provide a much improved estimate of C. However, it must be noted that the experiments described are limited, and thus the results of this work cannot be considered completely verified. (See also W79-04351) (Humphreys-ISWS)
W79-04373

VELOCITY DISTRIBUTION AND SEDIMENT MOTION INDUCED BY SHIP'S PROPELLER IN SHIP CHANNELS,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
Y-C. Liou, and J. B. Herbich.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 228-235, 1977. 2 fig. 1 tab, 7 ref.

Descriptors: *Sediment transport, *Canals, *Navigation, *Model studies, Mathematical models, Numerical analysis, Channels, Analytical techniques, Analysis, Bed load, Movement, Saltation, Velocity, Distribution patterns, Theoretical analysis.

A numerical model using the momentum theory of the propeller and Shields' diagram was developed to study sediment movement induced by a ship's propeller in a restricted waterway. The velocity distribution downstream of the propeller was simulated by the Gaussian normal distribution function. The shear velocity and shear stress were obtained using Sternberg's formulas. Once the ship's speed, depth of the waterway RPM and diameter of the propeller, and draft of the ship are given, the velocity distribution and the grain size of the initial motion could be obtained from this model. Case studies were presented to show the influence of significant factors on sediment movement at the channel bottom induced by a ship's propeller. (See also W79-04351) (Humphreys-ISWS)
W79-04374

THE SQUAT PHENOMENON AND RELATED EFFECTS OF CHANNEL GEOMETRY,
Army Engineer District, Galveston, TX.
E. T. Gates, and J. B. Herbich.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 236-244, 1977. 6 fig, 4 ref.

Descriptors: *Navigation, *Canals, *Hydraulics, *Flow characteristics, Channel flow, Channels, Boundary layers, Flow around objects, Flow, Ships, Movement, Inland waterways, Ship squat, Channel effects.

A vessel entering a restricted waterway is acted on by and reacts to a number of physical phenomena. These phenomena cause the ship to settle, to be pulled to the near bank, and to react to wind and current forces tending to skew the ship in the channel. Also, the waves and surges generated by the ship can be very dangerous to other craft, shore structures, and channel banks. Consideration of the effects of these phenomena must be included in navigation channel design and review procedures. Ship settling phenomenon and the effects of the naturally formed portion of a dredged navigation channel cross section were discussed. Squat is a function of the speed of the vessel, the cross-sectional area of the vessel, the cross-section area of the channel, and the location of the vessel's sailing line with respect to the centerline of the channel. Boundary layers tend to increase the effective cross-sectional area of the vessel and decrease the effective cross-sectional flow area of the channel, and they should be taken into consideration in determining the squat of the vessel. Design procedures should include the analysis of the design channel in its natural environment throughout the entire length of the channel. (See also W79-04351). (Humphreys-ISWS)
W79-04375

MAJOR PORT IMPROVEMENT ALTERNATIVES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
J. W. Berriman, and J. B. Herbich.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 245-252, 1977. 2 fig, 5 tab, 11 ref.

Descriptors: *Navigation, *Canals, *Transportation, *Harbors, Canal design, Ships, Channels, Open channels, Depth, Width, Dimensions, Design criteria.

Navigation facilities must be designed for good control and safe maneuvering of ships. The width, depth, and alignment of channels, and dimensions of maneuvering areas must be adequate for safe navigation but not excessive. The following channel design criteria are necessary to provide for the safe navigation of VLCC's and ULCC's, (1) Channel Width; Maneuvering Lane (A) =2.0 x Beam + L sin 10 deg where L sin 10 deg applies for channels with strong yawing forces, Bank Clearance Lane (B) = 1.5 x Beam, Ship Clearance Lane (C) = 1.0 x Beam, One-way Traffic Width =A + 2B, and Two way Traffic Width = 2A + 2B + C. (2) Channel Depth; Channel Depth in Inner Channel = f(loaded draft, squat, and minimum keel clearance), Channel Depth in Outer Channel = (loaded draft, effect of pitch and roll, and minimum keel clearance) where effect of roll and pitch = L/2 sin one deg. (See also W79-04351). (Humphreys-ISWS)
W79-04376

DIFFRACTION OF WAVES BY A SHORE-CONNECTED BREAKWATER,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
V. W. Harms.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 253-260, 1977. 5 fig, 9 ref.

Descriptors: *Waves(Water), *Breakwaters, *Hydraulic structures, *Model studies, Coastal structures, Shores, Hydraulic models, Laboratory tests, Analysis, Shore protection, Wave diffraction.

Laboratory tests were performed for a breakwater with and without a wave-splitter plate and waves normally incident upon the breakwater. The influence of a wave-splitter plate and wave reflections from the seaward side were investigated in comparative tests performed both in the intermittent and continuous data-acquisition modes. for the range of conditions investigated, the following conclusions can be made: (1) In general, there is satisfactory agreement between measurement and theory. However, diffraction theory was not found to be conservation because at large distances in the shadow zone, measured wave-heights consistently exceed theoretical values. Close to the breakwater outside the shadow zone, the measured maximum wave-height is again larger than predicted by theory. (2) The influence of a wave-splitter plate is

only detectable within a radius of aproximately four wavelengths from the tip, and even here the affect is minor. (3) The diffraction behavior appears to be insensitive to the intensity of wave reflections from the seaward side of the breakwater. (4) The 2-dimensional motion of a wide wave generator produced highly 3-dimensional long-crested waves that could not be explained in terms of a 3-dimensional linear wave generator theory. (5) The 3-dimensional incident wave field must be described with sufficient detail in order to permit interpretation of the diffraction profiles as the wave-response to the presence of a given structure. (See also W79-04351). (Humphreys-ISWS)
W79-04377

A GENERALIZED POINT-VELOCITY METHOD FOR DISCHARGE COMPUTATIONS IN TIDAL WATERWAYS,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
For primary bibliographic entry see Field 2L.
W79-04378

BIOLOGICAL AND ENGINEERING INVESTIGATION OF ANGLED FLUSH FISH DIVERSION SCREENS,
Stone and Webster Engineering Corp., Boston, MA. Environmental Engineering Div.
For primary bibliographic entry see Field 8I.
W79-04383

8C. Hydraulic Machinery

GROUND-HEAT-ASSISTED HEAT PUMPS,
E. F. Lindsley.
Popular Science, Vol. 214, No. 2, p 98-100, February, 1979.

Descriptors: *Heat pumps, *Thermal storage, *Plastic pipes, Solar panels, Water wells, Air conditioning.

Dr. James E. Bose, of Oklahoma State University, has designed and tested a heat pump system which stores waste hot water in an earth coil made of PVC. Such a system avoids the problems that plague air-source heat pumps due to variations in air-temperature. In the summer, hot water from air conditioners and solar panels is stored in the earth coil during the day and recirculated through the solar panels during the night to cool. During the winter the stored hot water increases the efficiency of the heat pump. The advantage of using earth coils in place of an underground storage tank is that they have more surface area for a given volume of water to store or deliver heat. An alternative to the earth coil is a vertical coil in a water well. Such a well does not have to produce an adequate supply of potable water since it houses the coil and water is not pumped from it. Bose's system is dependent on a moderate climate since frost would damage earth coils, and air conditioners and sunlight would provide little heat in northern climates. (Purdin-NWWA)
W79-04243

TAILORING A PUMP FOR FARM USE,
For primary bibliographic entry see Field 4A.
W79-04245

HEAT PUMP UPDATE.
For primary bibliographic entry see Field 6B.
W79-04246

8G. Materials

MASS TRANSFER IN NONUNIFORM PACKING,
Auburn Univ., AL. Dept. of Chemical Engineering.
A. Y. Tan, B. D. Prasher, and J. A. Guin.
AICHE Journal (American Institute of Chemical Engineers), Vol. 21, No. 2, p. 396-397, March 1975. 2 fig, 1 tab, 7 ref.

Descriptors: *Mass transfer, *Packed beds, Ergun equation, Size distribution.

A study was conducted on the effects of a randomly distributed nonuniform particle size upon the fluid-solid transfer coefficients. Reliable results can be obtained in such mass transfer runs by employing the hydraulic mean diameter from the Ergun equation when computing fluid-particle transfers in nonuniform packing.
W79-04127

ASPHALT-CRUMB RUBBER WATERPROOFING MEMBRANE,
Arizona Water Resources Research Center, Tucson.
R. K. Frobel, R. A. Jimenez, C. B. Cluff, and G. R. Morris.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR1, p 43-58, March, 1978. 10 fig, 1 tab, 11 ref, 4 equ, 1 append.

Descriptors: *Linings, *Reservoir leakage, *Seepage control, Waterproofing, Asphaltic concrete, Laboratory tests.

A mixture of asphalt cement mixed with crumb-rubber (asphalt-rubber) has been used successfully in highway construction for several years in Arizona and other states. This paper describes laboratory tests on asphalt-rubber and includes preliminary results of an actual reservoir lining application. (Skogerboe-Colorado State)
W79-04182

8H. Rapid Excavation

BLASTING-IT TURNS DRY HOLES INTO WET ONES,
Universal Oil Products, St. Paul, MN. Johnson Div.
For primary bibliographic entry see Field 8A.
W79-04251

8I. Fisheries Engineering

HYDRAULIC RESTORATION OF STREAM GRAVEL FOR SPAWNING AND REARING OF SALMON SPECIES,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
W. C. Mih.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 149, Price codes: A03 in paper copy, A01 in microfiche. State of Washington Water Research Center, Washington State University Technical Report, September 1978. 35 p, 13 fig, 10 tab, 8 ref. OWRT A-095-WASH(1), 14-34-0001-8051.

Descriptors: Anadromous fish, Salmon, *Spawning, *Spawning beds, Hydraulic excavation, Jets, Fisheries, Gravel, *Silt.

The removal of silt from the spawning beds of Pacific salmon can greatly increase the survival rate of salmon eggs. Research has shown that egg survival is expected to increase from 10 percent for uncleaned beds to 40 percent after cleaning operations. In view of the expected success of silt removal, attempts to develop methods capable of removing fine material from salmon spawning beds have been undertaken by various agencies. The use of water jets to flush out the fine material which is then removed by a suction system has been considered to hold the most promise. As a result, experimentation was conducted to determine the optimum operating condition for the use of hydraulic jets in the removal of silt from the salmon spawning beds. Results from the testing program clearly indicate the use of hydraulic jets is an efficient means of silt removal. For instance, a one inch diameter jet operating at 70 feet per second can remove the silt from the gravel 19 inches below the streambed surface. The testing program is continuing one more year to determine the cleaning efficiency of a moving jet with various configurations of suction hoods. This information has generated interest at the Washington State Department of Fisheries for the use of hydraulic jets in the design and construction of a full scale gravel cleaning machine.
W79-04260

DESERTIFICATION, DEVELOPMENT, AND THE 'ADMIRALS' OF MANCHAR LAKE IN SIND, PAKISTAN,
Wilfred Laurier Univ., Waterloo (Ontario).
K. Hewitt.
Economic Geography, Vol. 53, No. 4, p 358-363, Oct. 1977. 22 ref.

Descriptors: *Fishing, *Lake morphology, *Lake, *Fish management, *Fish farming, *Desertification, Fisheries, River flow, Stream improvement, Water utilization, Lake basins, Flow duration, River basin development, Carrying capacity, Fish populations, Environmental effects, Arid lands, Pakistan.

The fishermen of Pakistan's Sind Province who use the large inundation lake, Manchar, are analyzed here to illustrate the specific responses to increased aridity of the people outside or marginal to the urban-oriented, commercial economy and to point out the tremendous cultural and environmental complexities of desertification problems. Fishing has been a wide-spread human adaptation in the desert regions of the old world and ephemeral lakes and rivers have played a large role in the economy of certain desert people. The plight of the present day Sind Province fishermen illustrates the unique and highly constrained adjustments necessary for inhabitants of coastal deserts. The Manchar is essentially a seasonal lake, providing irrigation water during expansion and arable lake floor land when constricted. There is a point, however, when the lake becomes too small, limiting fish and carrying capacity potential and bringing about overcrowding and eventual drying out of the lake. Considerable uncertainty during lake contraction is often aggravated by climatic stress such as the disastrous flood of 1975, and poor human management has created dangerous levels of soil and water salinity. (Tickes-Arizona)
W79-04292

FISH RETURN SYSTEMS,
Stone and Webster Engineering Corp., Boston, MA. Environmental Engineering Div.
Y. G. Mussalli, and E. P. Taft, III.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 288-295, 1977. 4 fig, 10 ref.

Descriptors: *Fish handling facilities, *Hydraulic structures, *Conveyance systems, *Hydraulic systems, Fish barriers, Fish passages, Pumps, Bypasses, Hydraulic equipment, Jet pumps, Lift baskets, Centrifugal fish pumps, Screw pumps, Air lift pumps.

As a result of present regulatory requirements for the protection of fish at cooling water intakes, several power plant intakes are being designed to incorporate fish protection facilities and transportation systems to return live fish to their natural environment. Fish protection can be based in principle on three different concepts: fish collection and removal, fish diversion, and fish deterrence. The first two concepts require systems to return collected or diverted fish from circulating water systems to their natural environment. The third concept involves exclusion of fish prior to entering an intake. This paper described, in general, important parameters which should be considered in designing each element of various fish transport systems. These systems included bypasses, pumps, and lift baskets. (See also W79-04351)(Humphreys-ISWS)
W79-04381

Group 8I—Fisheries Engineering

FISH SCREENING-THE STATE OF THE PRACTICAL ART,
Burns and Roe Construction Corp., Paramus, NJ.
R. T. Richards.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 296-303, 1977. 7 fig.

Descriptors: *Fish handling facilities, *Fish barriers, *Hydraulic structures, *Reviews, Fish management, Conveyance structures, Hydraulic systems, Intakes structures, Screens, Trash racks, Fish passages.

This paper was a progress report on the investigation of the ASCE Task Committee on Fish-handling Capabilities of Intake Structures into presently available practical devices or systems for protecting fish at water intakes. The emphasis was on the term 'practical', limiting the discussion to technology which consists of readily available and proven components and which has consistantly demonstrated the ability to reduce fish mortality. This particular presentation was limited to the primary fish screening, fish guiding, and fish repulsion techniques. The 'practical' device or systems discussed are substantially effective in protecting fish, are available today without further mechanical development, can be operated at reasonable cost, and can be maintained without interfering with the very high availability factor required of power plant cooling water supplies. The technology must be of proven mechanical reliability. We shold keep in mind that for power plants the water intake must function at full capacity 24 hours a day, 7 days a week. (See also W79-04351)(Humphreys-ISWS)
W79-04382

BIOLOGICAL AND ENGINEERING INVESTIGATION OF ANGLED FLUSH FISH DIVERSION SCREENS,
Stone and Webster Engineering Corp., Boston, MA. Environmental Engineering Div.
E. P. Taft, III, and Y. G. Mussalli.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 304-312, 1977. 4 fig, 1 tab, 4 ref.

Descriptors: *Fish barriers, *Intakes structures, *Model studies, *Hydraulic structures, Bypasses, Screens, Fish management, Fish passage, Hydraulic models, Laboratory tests, Prototypes, Fish diversion screens.

This paper discussed the development of angled, flush-mounted, traveling screens which can be used to divert fish to bypasses without power plant intake screenwells. Although angled screens have not been utilized at power plants, they have been shown to be effective at hydroelectric facilities. Laboratory physical model studies with live fish were carried out to develop and optimize the design of the screen within the constraints imposed for power plant application. Utilizing information obtained, design criteria for effective application were established and the angled screen fish diversion system was incorporated into two power plant screenwells. On the basis of the development efforts, it appears that the angled, flush-mounted traveling screen concept may have the potential for diverting fish at other selected power plant intakes. (See also W79-04351)(Humphreys-ISWS)
W79-04383

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

ASCE MET SECTION STRIVING TO MAKE CIVIL ENGINEERING CURRICULA MORE PRACTICE-ORIENTED,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
R. P. Khera.
Civil Engineering, Vol. 48, No. 1, p 75, January, 1978.

Descriptors: Civil engineering, Engineering education, Education, Evaluation.

Concerned with deficiencies in civil engineering education and the limitations of the ECPD evaluation procedures, the ASCE Metropolitan Section Committee on Engineering Education set out to upgrade and monitor civil engineering education. A poll of Met Section members showed a desire for change in the direction of civil engineering education. Experimental review program of undergraduate civil engineering education was approved by the Met Section Board in April, 1968. It contemplated periodic visits to each of the undergraduate civil engineering departments in the Metropolitan area by a team of ASCE members. This article discusses in brief about the activities of the ASCE Met Section, the purpose it has served, and the procedure it follows to attain its objectives. (Skogerboe-Colorado State)
W79-04189

9C. Research Facilities

BALANCING THE INTERESTS. THE THIRD UN-LAW OF THE SEA CONFERENCE - (7TH SESSION),
For primary bibliographic entry see Field 6E.
W79-04441

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

STATUS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX)--SEPTEMBER 1978,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards.
Geological Survey open-file report 79-330, 1979. 11 p, 3 tab, 8 ref.

Descriptors: *Data storag and retrieval, *Hydrologic data, *Information retrieval, *Information exchange, *Indexing, Bibliographies, Surface waters, Sediments, Groundwater, Water quality, *National Water Data Exchange(NAWDEX), Water Data Sources Directory.

This report describes the activities of the National Water Data Exchange (NAWDEX) during Fiscal Year 1978, October 1, 1977 through September 30, 1978. Discussions include program administration, NAWDEX services, identification of sources of water data, indexing of available water data, development of systems to be used with the NAWDEX data bases, Water Data Sources Directory, and Master Water Data Index. (Woodard-USGS)
W79-04392

BALANCING THE INTERESTS. THE THIRD UN-LAW OF THE SEA CONFERENCE - (7TH SESSION),
For primary bibliographic entry see Field 6E.
W79-04441

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

10B. Reference and Retrieval

REPORT ON CIBOLA DIVISION (6) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact and Research.
For primary bibliographic entry see Field 6B.
W79-04105

REPORT ON IMPERIAL DIVISION (7) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact Research.
For primary bibliographic entry see Field 6B.
W79-04106

REPORT ON LAGUNA DIVISION (8) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact Research.
For primary bibliographic entry see Field 6B.
W79-04107

STATUS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX)--SEPTEMBER 1978,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 10A.
W79-04392

10D. Specialized Information Center Services

COMPUTER PROGRAMS IN WATER RESOURCES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 7C.
W79-04081

FINITE ELEMENT SOLUTION OF SAINT-VENANT EQUATIONS,
Nevada Univ., Reno.
R. L. Cooley, and S. A. Moin.
Journal of the Hydraulics Division, ASCE, Vol. 102, No. HY6, p 759-775, June 1976. 6 fig, 1 tab, 20 ref, 2 append. OWRT B-078-NEV(1).

Descriptors: *Equations, *Saint-Venant equations, Hydrology, Channels, Flood routing, Groundwater, Surface water, Mathematics, Surface-groundwater relationships.

A finite element solution for the open-channel flow equations is presented. These equations, developed to provide reliable methods to route flood waves or other disturbances along open channels, investigate the interrelationships between groundwater and surface water. In this work the finite element scheme is based on the Galerkin method. The solution method is described, followed by examples of the comparison of results with those of some other researchers. Three cases solved with this element solution are present. Conclusions drawn from this study include: (1) the Saint-Venant equations can be solved using the finite element method presented; (2) the predictor-corrector method was stable and accurate, but the implicit-explicit scheme produced oscillatory results and became unstable for a problem involving a large degree of nonlinearity; and (3) small time steps would have to be used to guarantee accuracy and stability of the implicit-explicit method. (Davison-IPA)
W79-04100

FORTRAN IV PROGRAM TO COMPUTE DIVERSITY INDICES FROM INFORMATION THEORY,
Kansas Univ., Lawrence. Dept. of Geology.
R. L. Kaesler, and P. S. Mulvany.
Computers and Geosciences, Vol. 2, p 509-514, 1976. 10 ref. OWRT C-6007(No 5200)(1), 14-31-

001-5200.

Descriptors: *Computer programs, *Programming languages, *Digital computers, Computer models, Data processing, Information retrieval, Equations, Geology, Sedimentation, Sedimentology, Sediment sorting, Systems analysis.

Diversity indices adopted from information theory are used to measure the structure of fossil communities. For comparison purposes, diversities are based on a constant number of individuals. A program computing diversity indices and related statistics of the total collection and a randomly selected subset is presented. This program consisting of the four principal sections, input, random sampling procedure, computation of diversity and equitability, and output, also includes a data deck and glossary of variables. A sample data deck is provided as a model. Each data deck generates one page of output containing identification information, input data, and two sets of output -- one for total sample and one for the random sample. Diversity indices and related statistics are discussed with regard to the appropriate conditions for using the equations which are employed in this program. (Davison-IPA)
W79-04262

FORTRAN IV PROGRAM TO COMPUTE REPLICATED DIVERSITY INDICES FOR RANDOM SAMPLES OF SPECIFIED SIZE,
Kansas Univ., Lawrence. Dept. of Geology.
R. L. Kaesler, and P. S. Mulvany.
Computers and Geosciences, Vol. 2, p 515-519, 1976. 4 ref. OWRT C-6007(No. 5200) (2), 14-31-001-5200.

Descriptors: *Computer programs, *Programming languages, *Digital computers, Computer models, Data processing, Data transmission, Information retrieval, Geology, Equations, Sedimentology, Sediment sorting.

Diversity indices adopted from information theory are used to measure the structure of fossil communities, and are usually based on a constant number of individual/collection. A program comparing diversities of large collections with diversities of small collections is presented. The program, consisting of five subsections to control input, printing of page headings, procedure for random sampling, computation of diversity, and output, includes three subroutines, FACT, DIVERS AND APPROX. It operates in two modes controlled by the option variable JOPT, and has a fully documented data deck. A sample data deck is provided. Each page of output contains a sample identification, the number of individuals in the random sample, the number of replications in the random sample, and the diversity indices which are arranged in two columns. (Davison-IPA)
W79-04263

FORTRAN IV PROGRAM TO COMPUTE HIERARCHICAL DIVERSITY,
Kansas Univ., Lawrence. Dept. of Geology.
P. S. Mulvany, and R. L. Kaesler.
Computers and Geosciences, Vol. 2, p 521-529, 1976. 1 fig, 5 ref. OWRT C-6007(5200)(3).

Descriptors: *Computer programs, *Programming languages, *Digital computers, Data processing, Geology, Data transmission, Information retrieval, Equations, Documentation, Animal groupings, Systematics.

In using indices of species diversity from information theory to assess fossil communities, diversity may be partitioned hierarchically to determine the diversity of orders, families within orders, genera within families, and species within genera. A program is presented which is designed for a two-, three-, or four-leveled taxonomic hierarchy. The option variable, JOPT, assigned a value of one, two, or three for the two-, three-, and four-leveled situations, controls the operational mode. The program was written using species as the first level, genus as the second level, family as the third level, and order as the fourth level. There are five sections and two subroutines in the program. The first section controls data input and the second computes the number of individuals in each tax on and the total number of individuals in the sample. The third section has four nested loops that compute ordinal diversity familial diversity of orders, generic diversity of families, and species diversity of genera. The fourth section computes composite diversities for each hierarchical level. The program also has a documented data deck and a glossary of variables. (Davison-IPA)
W79-04264

HYDRAULICS IN THE COASTAL ZONE.
For primary bibliographic entry see Field 2L.
W79-04351

10F. Preparation Of Reviews

TWELFTH ANNUAL REPORT, PROGRAM ACTIVITIES, JULY 1, 1975-JUNE 30, 1976.
Maryland Univ., College Park. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 958, Price codes: A04 in paper copy, A01 in microfiche, 1976. 59 p, 4 fig, 1 tab, 3 ref, 3 append. OWRT-A-999-MD(12).

Descriptors: *Water resources, *Maryland, *Organizations, Planning, Chesapeake Bay, Effluents, Sewage, Environmental effects, Cooling towers, Irrigation, Microbiology, Microorganisms, Bacteria, Viruses, Fishes, Toxicity, Sediments.

The current activities (1975-76) of the Maryland Water Resources Research Center are summarized. This institution, established in 1965, continues to stimulate, facilitate, support and coordinate reseach in the full spectrum of water-related problems and disciplines, with emphasis on reseach relevant to Maryland. The current status of the following projects is reported: heavy metals and minerals in Chesapeake Bay sediments; toxicity of waste water treatment plant effluents to fishes; mathematical model for estimating water quality loadings; groundwater fluctuation under heavy irrigation with sewage effluents; treatment costs versus environmental damage in state water resources management; water quality changes in oyster processing; mutagenic potential of petroleum byproducts in Chesapeake Bay waters; detection of enteroviruses surviving standard sewage treatment; detection of bacterial pathogens surviving standard sewage treatment; biotoxicity of chlorine species to copopeds; marsh ecosystem response to nutrients in agricultural runoff; characteristics of urban runoff, and the effects of a cooling tower on the environment. (Davison-IPA)
W79-04117

FISH SCREENING-THE STATE OF THE PRACTICAL ART,
Burns and Roe Construction Corp., Paramus, NJ.
For primary bibliographic entry see Field 8I.
W79-04382

SUBJECT INDEX

2

Experimental Evaluation of Chemical Transport in Water-Saturated Porous Media: 2. Sorbing Media,
W79-04014 5A

ABSORPTION
Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

ACCIDENTAL SPILLS
Time of Travel of Solutes in Louisiana Streams,
W79-04401 5B

ACCRETION
State Law, Not Federal, Determines Riparian Rights to Accretions,
W79-04450 6E

ACTIVATED SLUDGE
A Basis for Aeration Design,
W79-04002 5D

Viability Measurements on Activated Sludge,
W79-04006 5D

Model Studies on the Effects of Alum Sludge on the Activated Sludge Waste Treatment Process,
W79-04114 5D

Effects of Alum Water Treatment Sludge on Domestic Wastewater Sludges,
W79-04116 5D

ADMINISTRATION
Planning for Water Resources,
W79-04152 6D

ADMINISTRATIVE DECISIONS
Commonwealth Department of Environmental Resources V. City of Lebanon (Compulsory Fluoridation Held to Be a Furtherance of Public Health).
W79-04433 5G

ADSORPTION
The Complexing and Adsorption of Cadmium in Soils in the Presence of EDTA and NTA,
W79-04007 5B

Adsorption of Aldicarb by Clays and Soil Organo-Clay Complexes,
W79-04217 2K

Physico-Chemical Techniques for Treating Mill Effluents: A State-of-the-Art Review,
W79-04256 5D

AERATION
A Basis for Aeration Design,
W79-04002 5D

Wastewater Treatment for Small Rural Communities,
W79-04119 5D

AERIAL PHOTOGRAPHY
Vegetative Communities of the Great Dismal Swamp: Identification and Mapping with Seasonal Color Infrared Photographs,
W79-04018 7B

Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

AGRICULTURAL RUNOFF
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

AGRICULTURAL WATERSHEDS
Big Muddy River Comprehensive Basin Study, Illinois, Summary Report.
W79-04143 6D

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. 1, Main Report.
W79-04146 6G

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. VI: Appendix P - Plan Formulation.
W79-04147 6G

AGRICULTURE
Agriculture: Its Historic and Contemporary Roles in Arizona's Economy,
W79-04281 6D

AGROCLIMATOLOGY
Desertification of The Great Plains: Will it Happen,
W79-04285 2A

AIR ENTRAINMENT
Effect of Entrapped Soil Air on Infiltration,
W79-04124 2G

AIR POLLUTION
Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

Simultaneous Treatment of SO2 Containing Stack Gases and Waste Water,
W79-04480 5D

ALABAMA
Flood Frequency of Small Streams in Alabama,
W79-04024 6A

ALASKA
Water Resources Data for Alaska, Water Year 1977.
W79-04032 7C

Channel Erosion Surveys Along the Taps Route, Alaska 1977,
W79-04411 2J

Alaska Oil Discharge Prevention and Pollution Control Act Held Invalid Chevron U.S.A. Inc. v. Hammond,
W79-04424 6E

ALBEDO
Earth-Atmosphere Systems and Surface Reflectivities in Arid Regions from LANDSAT MSS Data,
W79-04297 2A

ALBERTA (CANADA)
Gravity-Induced Cross-Formational Flow of Formation Fluids, Red Earth Region, Alberta, Canada: Analysis, Patterns, and Evolution,
W79-04066 2F

ALGAE
Carbon Requirements of a Population of the Estuarine Copepod Eurytemora Affinis,
W79-04011 2L

Influence of Domestic Wastes on Energetic Pathways in Rocky Intertidal Communities,
W79-04133 5C

The Production of Mucilage by Diatoms in McConaughy, Pawnee and Yankee Hill Reservoirs and the Role of this Material in the Aquatic Environment,
W79-04310 2H

Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton,
W79-04318 5C

Spectrophotometricaly Assayed Inhibitory Effects of Mercuric Compounds on Anabaena Flos-Aquae and Anacystis Nidulans (Cyanophyceae),
W79-04327 5A

ALPINE AREAS
Precipitation Management and the Environment, an Overview of the Skywater IX Conference.
W79-04157 2B

ALUM SLUDGE
The Effects of Alum Sludge on Primary Sedimentation and Anaerobic Digestion,
W79-04001 5D

Model Studies on the Effects of Alum Sludge on the Activated Sludge Waste Treatment Process,
W79-04114 5D

The Effects of Alum Sludge on Anaerobic Digestion,
W79-04115 5D

Effects of Alum Water Treatment Sludge on Domestic Wastewater Sludges,
W79-04116 5D

AMMONIA
Ammonia in Texas Streams During Low Flow from Municipal Wastewater,
W79-04063 5B

Effects of Solution Chemistry and Environmental Conditions on Ammonia Volatilization Losses from Aqueous Systems,
W79-04180 2K

The Automatic Determination of ppb Levels of Ammonia, Nitrate Plus Nitrite, and Phosphate in Water in the Presence of Added Mercury (II) Chloride,
W79-04226 2K

AMPHIPODA
The Acute Toxicity of Copper to Gammarus Fasciatus Say, A Freshwate Amphipod,
W79-04342 5C

ANAEROBIC DIGESTION
The Effects of Alum Sludge on Primary Sedimentation and Anaerobic Digestion,
W79-04001 5D

ANALYSIS
Federal Water Pollution Control Act Discharge Permit System - An Industrial Viewpoint,
W79-04454 6E

ANALYTICAL TECHNIQUES
A Method for Parameter Sensitivity Analysis in Differential Equation Models,
W79-04229 6A

Let's Upgrade the BOD Test,
W79-04277 5A

Some Practical Techniques of Two-Dimensional Interpolation in Computational Hydraulics,
W79-04368 8B

On Numerical Accuracy in Computational Hydraulics,
W79-04369 8B

ANIMAL BEHAVIOR
Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

ANIMAL PHYSIOLOGY
Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

ANNE ARUNDEL COUNTY
Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

APPLICATION EQUIPMENT
Means and Method of Installing Emitters in Irrigation Tubing,
W79-04475 3F

APPROPRIATION
California v. United States (State Restrictions on Federal Appropriation of Water Upheld),
W79-04427 6D

Bureau of Reclamation Required to Comply with California Water Allocation Procedures,
W79-04455 6E

AQUATIC ENVIRONMENT
Aquatic Environmental Analysis in the Lower Yellow-Stone River,
W79-04276 6G

AQUATIC WEED CONTROL
Biological Control of Water Weeds with Plant Pathogens,
W79-04311 4A

Aquatic Herbicides,
W79-04476 4A

AQUATIC WEEDS
Wisconsin's Environmental Decade, Inc. v. Department of Natural Resources (City Policy Could not Prevent Chemical Treatment of State Waters),
W79-04428 2H

AQUIFER CHARACTERISTICS
Convective Contaminant Transport to Pumping Well,
W79-04022 5B

Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

Water Levels in Artesian and Nonartesian Aquifers of Florida, 1975-76,
W79-04404 2F

AQUIFER SYSTEMS
An Iterative Quasi-Three-Dimensional Finite Element Model for Heterogeneous Multiaquifer Systems,
W79-04125 2F

AQUIFERS
Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

A Finite Element Aquifer Model Which Takes Into Account Elevation Changes of the Aquifer,
W79-04083 2F

An Iterative Quasi-Three-Dimensional Finite Element Model for Heterogeneous Multiaquifer Systems,
W79-04125 2F

A Note on Packer, Slug, and Recovery Tests in Unconfined Aquifers,
W79-04128 2F

The Use of Bounding Wells to Counteract the Effects of Gravity in Dipping Aquifers,
W79-04496 4B

AQUITARDS
An Iterative Quasi-Three-Dimensional Finite Element Model for Heterogeneous Multiaquifer Systems,
W79-04125 2F

ARCH DAMS
Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Four Supplement: Dynamic Studies,
W79-04272 8A

Design and Analysis of Auburn Dam, Volume Four Appendices: Dynamic Studies,
W79-04273 8A

Design and Analysis of Auburn Dam, Volume Five: Summary and Conclusions,
W79-04274 8A

AREAS OF PARTICULAR CONCERN
Macomb County Area of Particular Concern Inventory.
W79-04148 6G

ARGENTINA
Land Tenure, Hazards, and the Economy: Viticulture in the Mendoza Oasis, Argentina,
W79-04291 3F

ARID LANDS
Technology and Desertification,
W79-04283 6A

Desertification of The Great Plains: Will it Happen,
W79-04285 2A

ARIZONA
Technology, Regional Interdependence, and Population Growth, Tucson, Arizona,
W79-04307 6B

ARKANSAS
Trace Metal Relationships in Bottom Sediments of a Fresh Water Stream--The Buffalo River, Arkansas,
W79-04017 2J

ARSENIC
Distribution of Arsenic in Soil Profiles After Repeated Applications of MSMA,
W79-04085 5B

Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

ARSENIC COMPOUNDS
Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

ARTIFICIAL RECHARGE
Artificial Recharge: Part II,
W79-04239 4B

ASSAY
Endotoxin in Waters of the State of Vermont,
W79-04492 5A

ASSESSMENTS
Assessing Nonpoint Water Quality for Small Streams,
W79-04051 5B

ATLANTIC SALMON
Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

ATRAZINE
Atrazine Mobility in Two Soils Under Conventional Tillage,
W79-04212 2G

ATTITUDES
The Additive and Interactive Effects of Powerlessness and Anomie in Predicting Opposition to Pollution Control,
W79-04010 5G

AUBURN DAM
Design and Analysis of Auburn Dam, Volume Five: Summary and Conclusions,
W79-04274 8A

BACKWATER
Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

BACTERIA
Bacterial Metabolism of Arylsulfonates: Role of Meta Cleavage in Benzene Sulfonate Oxidation by Pseudomonas Testosteroni,
W79-04013 5D

Transport of Microorganisms in Sand Columns,
W79-04211 2I

BARIUM
Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

BARNACLES
Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

BASE FLOW
Identification and Separation of Major Base Flow Components from a Stream Hydrograph,
W79-04067 2E

BASE FLOW SEPARATION
Identification and Separation of Major Base Flow Components from a Stream Hydrograph,
W79-04067 2E

BEACH POLLUTION
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

BEACHES
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

Wave Runup on Irregular Beach Profiles,
W79-04362 2L

The Fresh Water Lens in a Barrier Beach,
W79-04367 2L

Experimental Studies of Beach Scour Due to Wave Action,
W79-04386 2L

Who Owns Our Beaches,
W79-04418 6E

State v. Beach Company (Sporadic, Recreation use of Private Beachfront Land not Sufficient to Create Public Easement to Beach).
W79-04429 2J

Drawing the Line at the Oceanfront: The Role of Coastal Construction Setback Lines in Regulating Development of the Coastal Zone,
W79-04432 2J

Which Way to the Beach. Public Access to Beaches for Recreational Use,
W79-04435 6E

Robbins v. Lake Ossipee Village, Inc. (Beach Use and Right-of-Way Resevations in Deed Upheld).
W79-04437 6E

Access to the Nation's Beaches: Legal and Planning Perspectives,
W79-04448 6A

BEDS UNDER WATER
Dynamics of Wave-Induced Currents in Sediments,
W79-04076 2J

BELTZVILLE DAM (PA)
Prototype Reaeration Measurements, Beltzville Dam, Pennsylvania,
W79-04380 5G

BENEFICIAL USE
Cessation of Return Flow as a Means of Complying with Pollution Control Laws,
W79-04445 6E

BENTHIC FAUNA
Rocky Bottom Fauna in a Submarine Gulley at Loppkalven, Finnmark, Northern Norway,
W79-04057 2L

Effects of Non-Point Pollution on Benthic Invertebrates in the Lynnhaven River System,
W79-04071 5C

BENTHIC FLORA
Rocky Bottom Fauna in a Submarine Gulley at Loppkalven, Finnmark, Northern Norway,
W79-04057 2L

BIFIDOBACTERIA
Further Studies on Bifidobacteria as Indicators of Faecal Pollution in Water,
W79-04328 5A

BIG MUDDY RIVER BASIN (IL)
Big Muddy River Comprehensive Basin Study, Illinois, Summary Report.
W79-04143 6D

Big Muddy River Comprehensive Basin Study, Illinois, Vol. 7, Appendix M and N.
W79-04144 6D

BIOACCUMULATION
Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5B

Toxicities of Cadmium, Copper, and Zinc to Four Juvenile Stages of Chinook Salmon and Steelhead,
W79-04339 5C

Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

BIOASSAY
Development and Assessment of Acute Bioassay Techniques for the Littoral Rotifer, Philodina acuticornis,
W79-04120 5A

BIOCHEMICA OXYGEN DEMAND
Investigation of the Long-Term Effects of Chlorine on the Oxygen Demand of Wastewaters,
W79-04160 5D

BIOCHEMICAL OXYGEN DEMAND
Let's Upgrade the BOD Test,
W79-04277 5A

BIOCONTROL
Biological Control of Water Weeds with Plant Pathogens,
W79-04311 4A

BIODEGRADATION
Efficiency of Canal Biodegradation of Palm Oil Sludge and Its Pollution Effects,
W79-04332 5D

BIOINDICATORS
Further Studies on Bifidobacteria as Indicators of Faecal Pollution in Water,
W79-04328 5A

Relationship Between Indicator Organisms and Selected Pathogenic Bacteria in Urban Waterways,
W79-04330 5A

BIOLOGICAL COMMUNITIES
Influence of Domestic Wastes on Energetic Pathways in Rocky Intertidal Communities,
W79-04133 5C

BIOLOGICAL TREATMENT
Enso-Biox Method for Deodorization and Detoxification of Waste Waters,
W79-04295 5D

BIOLOGY
Life in the Great Salt Lake,
W79-04095 2H

BIOMASS
Earthworm Populations, Soil Bulk Density, Porosity, and Water Stable Aggregates under Effluent Application,
W79-04005 5C

Biomass and Primary Production in Freshwater Tidal Wetlands of the Middle Atlantic Coast,
W79-04485 2I

BIOTRANSFERENCE
Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

BIRD EGGS
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

BIVALVES
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

BIXLER RUN (PA)
Unit Sediment Graph,
W79-04172 2J

BLEACHING WASTES
Toxicity of Textile Waste to Some Teleost Fishes,
W79-04341 5C

Recent Effluent Color Reduction Trials at Alberni Pulp and Paper,
W79-04499 5D

BLUE GREEN ALGAE
Spectrophotometricaly Assayed Inhibitory Effects of Mercuric Compounds on Anabaena Flos-Aquae and Anacystis Nidulans (Cyanophyceae),
W79-04327 5A

BOTTOM SEDIMENTS
Dynamics of Wave-Induced Currents in Sediments,
W79-04076 2J

BOUNDARY DISPUTES
Florida Board of Trustees of the Internal Improvement Trust Fund V. Wakulla Silver Springs Company.
W79-04451 6E

BOUNDARY LAYERS
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

BOUNDARY PROCESSES
The Stability of a Two Layer Flow Without Shear in the Presence of Boundary Generated Turbulence: Field Verification,
W79-04372 8B

BRAZORIA COUNTY
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

BRAZOS RIVER (TX)
Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

BREAKWATERS
Diffraction of Waves by A Shore-Connected Breakwater,
W79-04377 8B

BROOK TROUT
Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

BROWARD COUNTY
Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

BUFFALO RIVER
Trace Metal Relationships in Bottom Sediments of a Fresh Water Stream--The Buffalo River, Arkansas,
W79-04017 2J

BUFFERS
Toxicity of Cupric Ion to Eggs of the Spot Leiostomus Xanthurus and the Atlantic Silverside Menidia Menidia,
W79-04314 5C

BUILDING CODES
Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

BURNING
Stubble Burn Scores.
W79-04167 3F

BUXTON CREEK (LA)
Flood Plain Information: Buxton Creek and Tributaries, Dequincy, Louisiana.
W79-04150 2E

CACHE VALLEY (UTAH)
Multiple Use of Irrigation Canals,
W79-04096 6D

CADMIUM
The Complexing and Adsorption of Cadmium in Soils in the Presence of EDTA and NTA,
W79-04007 5B

Copper and Cadmium Adsorption Characteristics of Selected Acid and Calcareous Soils,
W79-04210 2K

The Influence of Salinity on Toxicity of Cadmium and Chromium to the Blue Crab, Callinectes Sapidus,
W79-04319 5C

Toxicities of Cadmium, Copper, and Zinc to Four Juvenile Stages of Chinook Salmon and Steelhead,
W79-04339 5C

Acutely Lethal Levels of Cadmium, Copper, and Zinc to Adult Male Coho Salmon and Steelhead,
W79-04340 5C

CALCIUM
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

CALCIUM IONS
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

CALIFORNIA
Water Resources Data for California, Water Year 1977--Volume 2. Pacific Slope Basins from Arroyo Grande to Oregon State Line Except Central Valley.
W79-04394 7C

Water Resources Data for California, Water Year 1977--Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.
W79-04395 7C

Water Resources Data for California, Water Year 1977--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W79-04397 7C

Water Resources Data for California, Water Year 1977--Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line.
W79-04398 7C

Who Owns Our Beaches,
W79-04418 6E

Notes on California's Coastal Governance: A Reply to Peter Douglas,
W79-04444 6A

CALVERT COUNTY
Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

CAMAS PRAIRIE
Water Resources of Camas Prairie, South-Central Idaho,
W79-04031 2F

CANADA
Ground Water of the Island of Montreal, Canada,
W79-04060 2F

Gravity-Induced Cross-Formational Flow of Formation Fluids, Red Earth Region, Alberta, Canada: Analysis, Patterns, and Evolution,
W79-04066 2F

CANADA WATER ACT
The Canada Water Act Annual Report, 1977-1978.
W79-04154 6E

CANAL CONSTRUCTION
The CAP - An Engineering Marvel,
W79-04294 8A

CANAL DESIGN
The CAP - An Engineering Marvel,
W79-04294 8A

CANALS
Multiple Use of Irrigation Canals,
W79-04096 6D

A Winning Battle Against Destruction,
W79-04284 3F

Velocity Distribution and Sediment Motion Induced by Ship's Propeller in Ship Channels,
W79-04374 8B

The Squat Phenomenon and Related Effects of Channel Geometry,
W79-04375 8B

Major Port Improvement Alternatives,
W79-04376 8B

CARBON DIOXIDE
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

CARIBBEAN
Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

CATION ADSORPTION
Surface Charge Manipulation of Constant Surface Potential Soil Colloids: I. Relation to Sorbed Phosphorus,
W79-04203 2K

Copper and Cadmium Adsorption Characteristics of Selected Acid and Calcareous Soils,
W79-04210 2K

Potassium and Rubidium Adsorption and Diffusion in Soil,
W79-04216 2K

Multicomponent Cation Adsorption During Convective-Dispersive Flow Through Soils: Experimental Study,
W79-04218 2K

CATION EXCHANGE
Application of Ion Exchange Membranes to Sampling and Enrichment: Interference of Metal Ion Binding Groups,
W79-04103 1A

Transient Changes in the Soil-Water System from Irrigation with Saline Water: I. Theory,
W79-04202 2G

Thermodynamics of Potassium-Calcium and Magnesium-Calcium Exchange Reactions on a Kaolinitic Soil Clay,
W79-04209 2K

CENTRAL ARIZONA PROJECT
The CAP - An Engineering Marvel,
W79-04294 8A

CENTRAL FLORIDA
Radium-226 in Ground Water of West Central Florida,
W79-04065 5B

CHANNA
Alteration in the Activities of Three Peptidases and Lipase in the Digestive System of the Fish Channa Punctatus Exposed to Lead Nitrate,
W79-04345 5C

CHANNEL EROSION
Channel Erosion Surveys Along the Taps Route, Alaska 1977,
W79-04411 2J

CHANNEL FLOW
Salt Pickup by Overland Flow in the Price River Basin, Utah,
W79-04298 2E

CHANNEL IMPROVEMENT
The Disastrous Flood of '78,
W79-04299 2B

CHANNEL MORPHOLOGY
Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

CHANNELS
The Effect of Ice Cover on Vertical Tranfer in Stream Channels,
W79-04062 2E

CHAPARRAL
Small Mammal Habitat in Different-Aged Chamise-Wedgeleaf Ceanothus Chaparral,
W79-04259 4A

CHARLES COUNTY
Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

CHELATION
Development of a DTPA Soil Test for Zinc, Iron, Manganese, and Copper,
W79-04179 2K

CHEMICAL ANALYSIS
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

CHEMICAL WASTES
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

Efficiency of Canal Biodegradation of Palm Oil Sludge and Its Pollution Effects,
W79-04332 5D

Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

CHEMICALS
Wisconsin's Environmental Decade, Inc. v. Department of Natural Resources (City Policy

Could not Prevent Chemical Treatment of State Waters),
W79-04428 2H

CHLORDANE
Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

CHLORINATED HYDROCARBON PESTICIDES
Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton,
W79-04318 5C

CHLORINATION
Investigation of the Long-Term Effects of Chlorine on the Oxygen Demand of Wastewaters,
W79-04160 5D

CHROMIUM
The Influence of Salinity on Toxicity of Cadmium and Chromium to the Blue Crab, Callinectes Sapidus,
W79-04319 5C

CIBOLA DIVISION (6)
Report on Cibola Division (6) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04105 6B

CITIES
A Cross-Sectional Investigation of the Determinants of Urban Residential Water Demand in the United States, 1960 and 1970,
W79-04003 6D

CITIZENS PARTICIPATION
Perceptions of Effective Public Participation in Water Resources Decision Making and Their Relationship to Levels of Participation,
W79-04493 6B

CIVIL LAW
The Use of Civil Penalties in Enforcing the Clean Water Act Amendments of 1977,
W79-04449 6E

CLAMS
Acute Toxicity of the Water-Soluble Fraction of Cook Inlet Crude Oil to the Manila Clam,
W79-04323 5C

CLARIAS
Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

CLARIFIERS
Experience with the Operation of an Effluent Clarifier (Experience d'operation d'un clarificateur d'effluents),
W79-04305 5D

CLAY MINERALS
Adsorption of Aldicarb by Clays and Soil Organo-Clay Complexes,
W79-04217 2K

CLOUD SEEDING
Precipitation Management and the Environment, an Overview of the Skywater IX Conference.
W79-04157 2B

COAL MINE WASTES
Ground Water of the Fort Union Coal Region, Eastern Montana.
W79-04405 5B

COAL MINES
Environmental Effects of Western Coal Surface Mining, Part II: The Aquatic Macroinvertebrates of Trout Creek, Colorado,
W79-04252 5C

COASTA
Wave Runup on Irregular Beach Profiles,
W79-04362 2L

COASTAL PLAINS
Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

COASTAL STRUCTURES
Experimental Studies of Beach Scour Due to Wave Action,
W79-04386 2L

COASTAL ZONE MANAGEMENT
Macomb County Area of Particular Concern Inventory.
W79-04148 6G

COASTS
Rocky Bottom Fauna in a Submarine Gulley at Loppkalven, Finnmark, Northern Norway,
W79-04057 2L

Macomb County Area of Particular Concern Inventory.
W79-04148 6G

Hydraulics in the Coastal Zone.
W79-04351 2L

A Set of Coordinated Mathematical Models for the Coastal Zone,
W79-04353 2L

Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies,
W79-04359 2L

The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

Evaluation of a Barrier Against Seawater Intrusion,
W79-04370 2L

Notes on California's Coastal Governance: A Reply to Peter Douglas,
W79-04444 6A

Federal Lands and Consistency: An Intergovernmental Planning Proposal for the Coastal Zone,
W79-04446 6A

COLIFORMS
Rapid Method for Determining Numbers of Sewage Pollution Bacteria (e.g., Coliforms) in Water,
W79-04389 5A

COLLOIDS
Surface Charge Manipulation of Constant Surface Potential Soil Colloids: I. Relation to Sorbed Phosphorus,
W79-04203 2K

COLOR
Recent Effluent Color Reduction Trials at Alberni Pulp and Paper,
W79-04499 5D

COLORADO
Flooding and Sediment Transport in a Small Alpine Drainage Basin in Colorado,
W79-04090 2J

Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

COLORADO RIVER
Economic Analysis of the Conjunctive Use of Surface Water and Ground Water of Differing Prices and Qualities: A Coming Problem for Arizona Agriculture,
W79-04104 6B

Report on Cibola Division (6) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04105 6B

Report on Imperial Division (7) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04106 6B

Report on Laguna Division (8) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04107 6B

COLORADO RIVER BASIN
Water Resources Data for California, Water Year 1977--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W79-04397 7C

COMMUNITY DEVELOPMENT
Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part I,
W79-04109 4A

Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part II,
W79-04110 4A

Technology, Regional Interdependence, and Population Growth, Tucson, Arizona,
W79-04307 6B

COMPETING USES
Water Allocation: Constraints and Opportunities,
W79-04442 6E

COMPREHENSIVE PLANNING
The Legal Significance of the Local Government Comprehensive Plan,
W79-04420 6E

Notes on California's Coastal Governance: A Reply to Peter Douglas,
W79-04444 6A

Federal Lands and Consistency: An Intergovernmental Planning Proposal for the Coastal Zone,
W79-04446 6A

COMPUTER MODELS
Irrigate--A Scheduling Model,
W79-04188 3F

Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

COMPUTER PROGRAMMING
A Nonlinear Programming Algorithm for Real-Time Hourly Reservoir Operations,
W79-04482 6B

COMPUTER PROGRAMS
Hydrologic Data for Soldier Creek Basin, Kansas,
W79-04026 7C

Computer Programs in Water Resources,
W79-04081 7C

Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

Fortran IV Program to Compute Diversity Indices from Information Theory,
W79-04262 10D

Fortran IV Program to Compute Replicated Diversity Indices for Random Samples of Specified Size,
W79-04263 10D

Fortran IV Program to Compute Hierarchical Diversity,
W79-04264 10D

CONCRETE DAMS
Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Four Supplement: Dynamic Studies,
W79-04272 8A

Design and Analysis of Auburn Dam, Volume Five: Summary and Conclusions,
W79-04274 8A

CONEMAUGH RIVER
Floods of July 19-20, 1977, in the Johnstown Area, Western Pennsylvania,
W79-04413 2E

CONFERENCES
Hydraulics in the Coastal Zone.
W79-04351 2L

Conservation and the New Informal Composite Negotiating Text of the Law of the Sea Conference,
W79-04440 6E

CONJUNCTIVE USE
Conjunctive Ground and Surface Water Allocations: The Economics of a Quasi-Market Solution,
W79-04078 6B

CONNECTICUT RIVER
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

CONSERVATION
Macomb County Area of Particular Concern Inventory.
W79-04148 6G

CONSTITUTIONAL LAW
Pope V. City of Atlanta (Act Regulating Construction in River Flood Plain Held Not to Be Unconstitutional Taking of Property Without Compensation).
W79-04452 6E

CONSTRUCTION
Drawing the Line at the Oceanfront: The Role of Coastal Construction Setback Lines in Regulating Development of the Coastal Zone,
W79-04432 2J

CONSUMPTIVE USE
Cessation of Return Flow as a Means of Complying with Pollution Control Laws,
W79-04445 6E

CONTINENTAL SHELF
Mean Upwelling Velocities on the Oregon Continental Shelf During Summer 1973,
W79-04059 2L

Coastal Communities - Partners or Puppets in Outer Continental Shelf Development,
W79-04426 6E

CONTROL SYSTEMS
Station Timing Selection Circuit for Irrigation Controller,
W79-04462 3F

CONVEYANCE SYSTEMS
Fish Return Systems,
W79-04381 8I

COOLING TOWERS
Effects of Evaporative Salt Water Cooling Towers on Salt Drift and Salt Deposition on Surrounding Soils,
W79-04220 5B

COOLING WATER
Selective Withdrawal from Two-Layer Fluid,
W79-04123 8B

COPPER
Behavior of a Micro Flowthrough Copper Ion-Selective Electrode System in the Millimolar to Submicromolar Concentration Range,
W79-04102 1A

Copper and Cadmium Adsorption Characteristics of Selected Acid and Calcareous Soils,
W79-04210 2K

Toxicity of Cupric Ion to Eggs of the Spot Leiostomus Xanthurus and the Atlantic Silverside Menidia Menidia,
W79-04314 5C

Toxicities of Cadmium, Copper, and Zinc to Four Juvenile Stages of Chinook Salmon and Steelhead,
W79-04339 5C

Acutely Lethal Levels of Cadmium, Copper, and Zinc to Adult Male Coho Salmon and Steelhead,
W79-04340 5C

The Acute Toxicity of Copper to Gammarus Fasciatus Say, A Freshwate Amphipod,
W79-04342 5C

The Effect of Temperature on Copper Tolerance of Paramecium,
W79-04343 5C

CORTLAND COUNTY
Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

COST ANALYSIS
Obtaining Specifications for Minimum Cost Irrigation Systems,
W79-04012 6A

Heat Pump Update.
W79-04246 6B

Effects of Planting Configuration on Water Use and Economics of Drip Irrigation Systems,
W79-04302 3F

Corporate Compliance and Compensation Problems in Environmental Protection: Implications of United States v. Reserve Mining Company,
W79-04431 5G

The Use of Civil Penalties in Enforcing the Clean Water Act Amendments of 1977,
W79-04449 6E

COST-BENEFIT ANALYSIS
Interim Report, South Umpqua River. Volume II, Appendix A: Economic Data and Analysis.
W79-04140 6C

COSTS
Irrigation Piep Repair Cuts Costs,
W79-04185 8A

How Idaho Irrigators Trim Back Power Costs,
W79-04186 3F

CRABS
The Influence of Salinity on Toxicity of Cadmium and Chromium to the Blue Crab, Callinectes Sapidus,
W79-04319 5C

CROP PRODUCTION
'No Room for Error' Say Young Irrigator.
W79-04168 3F

CROP RESPONSE
Effect of Irrigation Regime on Maize Yields,
W79-04174 3F

A Technique for Assessing Seedling Emergence Under Drought Stress,
W79-04280 3F

Water Economy and Saline Water Use by Drip Irrigation,
W79-04303 3F

CROSS-SECTIONS
Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

CRUDE OIL
Firth of Forth Oil Pollution Incident, February 1978,
W79-04316 5B

Acute Toxicity of the Water-Soluble Fraction of Cook Inlet Crude Oil to the Manila Clam,
W79-04323 5C

The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

CUNNER
The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

CYPRESS LAKE
Limnological Characteristics of Cypress Lake, Upper Kissimmee River Basin, Florida,
W79-04025 2H

DALLAS (TX)
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume I.
W79-04135 5D

Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

DAM DESIGN
Design and Analysis of Auburn Dam, Volume One: Design Data,
W79-04268 8A

Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

DAM FAILURE
Floods of July 19-20, 1977, in the Johnstown Area, Western Pennsylvania,
W79-04413 2E

DAM FOUNDATIONS
Design and Analysis of Auburn Dam, Volume Two: Foundation Studies,
W79-04269 8A

DAMAGES
The Economic Impact of Increased Forest and Farmland Beaver Damage in Mississippi,
W79-04074 2H

Liability for Oil Pollution Under the Merchant Shipping (Oil Pollution) Act 1971,
W79-04425 6E

DAMS
Design and Analysis of Auburn Dam, Volume One: Design Data,
W79-04268 8A

Design and Analysis of Auburn Dam, Volume Two: Foundation Studies,
W79-04269 8A

DAMSITES
Design and Analysis of Auburn Dam, Volume One: Design Data,
W79-04268 8A

DANBURY (NH)
Hill Reestablishment: Retrospective Community Study of a Relocated New England Town,
W79-04158 6B

DATA COLLECTION
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

DATA COLLECTIONS
Hydrologic Data for Soldier Creek Basin, Kansas,
W79-04026 7C

Design and Analysis of Auburn Dam, Volume Four Supplement: Dynamic Studies,
W79-04272 8A

Data Needs in Urban Hydrology,
W79-04409 7A

DATA STORAG AND RETRIEVAL
Status of the National Water Data Exchange (NAWDEX)--September 1978,
W79-04392 10A

DATA STORAGE AND RETRIEVAL
Green River Data Base System,
W79-04009 4A

DAYS CREEK (OR)
Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

DDD
Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

DDT
Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

DECISION MAKING
Perceptions of Effective Public Participation in Water Resources Decision Making and Their Relationship to Levels of Participation,
W79-04493 6B

DECOLORING
The Removal of Color from Effluent Using Various Adsorbents: Some Preliminary Economic Considerations,
W79-04253 5D

DEEP WELLS
Drain-Hole Drilling Can Increase Productivity,
W79-04249 8A

DELAWARE BAY
The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

DENITRIFICATION
The Role of Nitrate Diffusion in Determining the Order and Rate of Denitrification in Flood Soil: I. Experimental Results,
W79-04130 2G

Factors Affecting Denitrification in a Sonoran Desert Soil,
W79-04204 2K

Disposition of 15N-Labeled Fertilizer Nitrate Applied During Corn Culture in Field Lysimeters,
W79-04223 3F

Denitrification in Four California Soils: Effect of Soil Profile Characteristics,
W79-04234 2G

DENSITY STRATIFICATION
Modification of the Chezy Roughness Coefficient by Density Stratification,
W79-04373 8B

DENVER
Trace Elements in Runoff from Rainfall and Snowmelt at Several Localities in the Denver, Colorado, Metropolitan Area,
W79-04019 5B

DENVER (CO)
South Platte River Basin Accomplishment Plan.
W79-04145 5G

DEQUINCY (LA)
Flood Plain Information: Buxton Creek and Tributaries, Dequincy, Louisiana.
W79-04150 2E

DESALINATION
You Never Miss the Water ... Till the Well Runs Dry,
W79-04244 6D

Sea Water Desalinization System,
W79-04472 3A

DESALINATION APPARATUS
Sea Water Desalinization System,
W79-04472 3A

DESALINATION PROCESSES
Power Generation and Potable Water Recovery from Salinous Water,
W79-04468 3A

DESERTIFICATION
Perspectives on Desertification,
W79-04282 3F

Technology and Desertification,
W79-04283 6A

Desertification of The Great Plains: Will it Happen,
W79-04285 2A

Desertification of Arid Lands,
W79-04287 2A

Desertification, Development, and the 'Admirals' of Manchar Lake in Sind, Pakistan,
W79-04292 8I

Resettlement and Desertification: The Wagogo of Dodoma District, Tanzania,
W79-04296 6A

DESERTS
Factors Affecting Denitrification in a Sonoran Desert Soil,
W79-04204 2K

DESIGN CRITERIA
Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

DESIGN SPECIFICATIONS
Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

DETENTION RESERVOIRS
Dual Purpose Detention Basins and Surveillance Procedures in Urbanizing Watersheds,
W79-04077 4C

DETOXIFICATION
Toxicity Removed by Foam Separation,
W79-04254 5D

DETRITUS
Transportation of Organic Detritus in Estuaries,
W79-04388 2L

DEWATERING
The Filter Belt Press -- Application and Design,
W79-04286 5D

DIATOMS
The Production of Mucilage by Diatoms in McConaughy, Pawnee and Yankee Hill Reservoirs and the Role of this Material in the Aquatic Environment,
W79-04310 2H

DIFFUSIVITY
Determination of Aquifer Diffusivity from Annual Fluctuations of Ground Water Levels,
W79-04069 2F

DIFLUBENZURON
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

DIGITAL COMPUTERS
Fortran IV Program to Compute Diversity Indices from Information Theory,
W79-04262 10D

Fortran IV Program to Compute Replicated Diversity Indices for Random Samples of Specified Size,
W79-04263 10D

Fortran IV Program to Compute Hierarchical Diversity,
W79-04264 10D

DISCHARGE RATE
Riverine Influence on Estuaries: A Case Study,
W79-04350 2L

DISCHARGE (WATER)
Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

A Hydraulic Model Study of Propeller-Type Lake Destratification Pumps,
W79-04079 2H

Selective Withdrawal from Two-Layer Fluid,
W79-04123 8B

DISCHARGE (WATER)

A Generalized Point-Velocity Method for Discharge Computations in Tidal Waterways,
W79-04378 2L

DISPERSION
Water: A Comprehensive Treatise. (Vol. 5). Water in Disperse Systems.
W79-04257 1B

Modeling Dissolved Oxygen in the Near-Field,
W79-04366 5B

Diffusion of Dredged Material in the Mississippi River,
W79-04384 5B

DISPOSAL
Productive Land Use of Dredged Material Containment Areas,
W79-04385 5E

DISSOLVED OXYGEN
Modeling Dissolved Oxygen in the Near-Field,
W79-04366 5B

DISTRIBUTION PATTERNS
Desertification of Arid Lands,
W79-04287 2A

DISTRIBUTION SYSTEMS
Obtaining Specifications for Minimum Cost Irrigation Systems,
W79-04012 6A

DIVERSION
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

DOMESTIC WASTES
Influence of Domestic Wastes on Energetic Pathways in Rocky Intertidal Communities,
W79-04133 5C

DRAG
Improved Drag Force Linearizations for Structural Dynamic Calculations,
W79-04358 8B

DRAINAGE
To Solve Highway and Farm Water Management Problems,
W79-04190 4C

Topological Classifications of Drainage Networks: An Evaluation,
W79-04232 2A

Freeland v. Dickson (Lower Landowner has no Right to Unimpeded Flow of Surface Water onto his Land),
W79-04434 2F

DRAINAGE ENGINEERING
Tailoring a Pump for Farm Use,
W79-04245 4A

DRAINAGE PROGRAMS
Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part I,
W79-04109 4A

Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part II,
W79-04110 4A

DRAWDOWN
A Finite Element Aquifer Model Which Takes Into Account Elevation Changes of the Aquifer,
W79-04083 2F

Water Levels in Artesian and Nonartesian Aquifers of Florida, 1975-76,
W79-04404 2F

DREDGING
Dredged Material Research Program, Fourth Annual Report.
W79-04044 6G

Elutriate-Primary Productivity Bioassays of Dredge Spoil Disposal in Lake Erie,
W79-04329 5B

Diffusion of Dredged Material in the Mississippi River,
W79-04384 5B

Productive Land Use of Dredged Material Containment Areas,
W79-04385 5E

American Dredging Company v. State Department of Environmental Protection (Order Banning Dumping of Dredge Soil in Protected Wetlands Area Upheld),
W79-04415 5G

DRILLING
Drain-Hole Drilling Can Increase Productivity,
W79-04249 8A

Blasting-It Turns Dry Holes into Wet Ones,
W79-04251 8A

DRIP IRRIGATION
Drip and/or Sprinkler,
W79-04192 3F

Drip Irrigation-Chemical, Physical Ways to Keep Emitters Open,
W79-04196 3F

Drip Systems Standards and Specifications.
W79-04200 3F

Effects of Planting Configuration on Water Use and Economics of Drip Irrigation Systems,
W79-04302 3F

Water Economy and Saline Water Use by Drip Irrigation,
W79-04303 3F

Value of Drip Irrigation Compared with Conventional Irrigation for Vegetable Production in a Hot Arid Climate,
W79-04304 3F

DROUGHT RESISTENCE
A Technique for Assessing Seedling Emergence Under Drought Stress,
W79-04280 3F

DROUGHTS
Desertification of The Great Plains: Will it Happen,
W79-04285 2A

DRY FARMING
Perspectives on Desertification,
W79-04282 3F

Resettlement and Desertification: The Wagogo of Dodoma District, Tanzania,
W79-04296 6A

E. COLI
Further Studies on Bifidobacteria as Indicators of Faecal Pollution in Water,
W79-04328 5A

EARTHQUAKE ENGINEERING
Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

EARTHWORMS
Earthworm Populations, Soil Bulk Density, Porosity, and Water Stable Aggregates under Effluent Application,
W79-04005 5C

EASEMENTS
Robbins v. Lake Ossipee Village, Inc. (Beach Use and Right-of-Way Resevations in Deed Upheld).
W79-04437 6E

EASTERN UNITED STATES
Geothermal Goes East,
W79-04248 3C

ECONOMIC BENEFITS
Big Muddy River Comprehensive Basin Study, Illinois, Vol. 7, Appendix M and N.
W79-04144 6D

ECONOMIC FEASIBILITY
Disintegration of a Traditional Resource-Use Complex: The Otomi of the Mezquital Valley, Hidalgo, Mexico,
W79-04293 6G

ECONOMIC IMPACT
Agriculture: Its Historic and Contemporary Roles in Arizona's Economy,
W79-04281 6D

Disintegration of a Traditional Resource-Use Complex: The Otomi of the Mezquital Valley, Hidalgo, Mexico,
W79-04293 6G

Water Control and Desertification, the Resettled Nomads of Deh Luran, Iran,
W79-04306 6A

ECONOMIC IMPACTS
Hill Reestablishment: Retrospective Community Study of a Relocated New England Town,
W79-04158 6B

ECONOMICS
Interim Report, South Umpqua River. Volume II, Appendix A: Economic Data and Analysis.
W79-04140 6C

EFFLUENTS
Citizens' Committee to Preserve Lake Logan v. Williams (State Agency's Maintenance of Water Quality Through Control of Effluents Found too Strict),
W79-04430 5D

E. I. Dupont De Nemours & Co. v. Train - EPA Authority to set Industry Wide Effluent Limitations by Regulation,
W79-04439 6E

ELECTRIC POWER
Electric Power Development in the Pacific Northwest Region: Institutional Commitments and Alternatives, Phase 2,
W79-04159 6E

ELECTRO-OSMOSIS
Hydraulic and Electro-Osmotic Permeability Coefficients,
W79-04092 2F

ELECTRODES
Behavior of a Micro Flowthrough Copper Ion-Selective Electrode System in the Millimolar to Submicromolar Concentration Range,
W79-04102 1A

ELUTRIATE
Elutriate-Primary Productivity Bioassays of Dredge Spoil Disposal in Lake Erie,
W79-04329 5B

EMINENT DOMAIN
American Dredging Company v. State Department of Environmental Protection (Order Banning Dumping of Dredge Soil in Protected Wetlands Area Upheld).
W79-04415 5G

ENDRIN
In Vivo Effect of Endrin on Three Phosphatases in Kidney and Liver of the Fish Ophiocephalus Punctatus,
W79-04333 5C

ENERGY
Energy and Water Resources.
W79-04112 6D

Accomplishment Plan, Region VIII. Comprehensive Energy-Environment Program.
W79-04137 6E

Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

ENERGY DISSIPATION
Spillway Stilling Basin for Low Froude Flows,
W79-04355 8B

ENERGY IMPACT
Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

ENERGY POLICY
Electric Power Development in the Pacific Northwest Region: Institutional Commitments and Alternatives, Phase 2,
W79-04159 6E

ENERGY RESOURCES
Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

ENGLAND
Planning for Water Resources,
W79-04152 6D

ENTERIC BACTERIA
Further Studies on Bifidobacteria as Indicators of Faecal Pollution in Water,
W79-04328 5A

ENTOMOLOGY
A Record of Palaeodipteron Walkeri Ide (Diptera: Nymphomyiidae) from Maine: A Species and Family New to the United States,
W79-04265 6G

ENVIRONMENTAL CONTROL
Precipitation Management and the Environment, an Overview of the Skywater IX Conference.
W79-04157 2B

Progress of Protection of the Environment and Resources in the United States-A Historical Survey,
W79-04278 6E

Drawing the Line at the Oceanfront: The Role of Coastal Construction Setback Lines in Regulating Development of the Coastal Zone,
W79-04432 2J

ENVIRONMENTAL EFFECT
Environmental Effects of Western Coal Surface Mining, Part II: The Aquatic Macroinvertebrates of Trout Creek, Colorado,
W79-04252 5C

ENVIRONMENTAL EFFECTS
Dredged Material Research Program, Fourth Annual Report.
W79-04044 6G

Precipitation Management and the Environment, an Overview of the Skywater IX Conference.
W79-04157 2B

Idaho's Environment (Problem of Unfettered Exploitation Rights v. Environmental Concern),
W79-04421 5D

Floating Nuclear Plants - A 'Reasonable Use' of the High Seas,
W79-04436 6E

ENVIRONMENTAL IMPACTS
Interim Report, South Umpqua River. Volume IV, Appendices E Through J, Reports of Coordinating Agencies.
W79-04141 6G

ENZYMES
The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

In Vivo Effect of Endrin on Three Phosphatases in Kidney and Liver of the Fish Ophiocephalus Punctatus,
W79-04333 5C

Alteration in the Activities of Three Peptidases and Lipase in the Digestive System of the Fish Channa Punctatus Exposed to Lead Nitrate,
W79-04345 5C

EQUATIONS
Finite Element Solution of Saint-Venant Equations,
W79-04100 10D

The Dependence of the Parameters in the Green and Ampt Infiltration Equation on the Initial Water Content in Draining and Wetting States,
W79-04155 2G

EQUIPMENT
Irrigation Piep Repair Cuts Costs,
W79-04185 8A

EROSION
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

Erosion Prediction on California Rangeland: Research Developments and Needs,
W79-04487 4D

ERROR ANALYSIS
Some Errors in Precipitation Measurements,
W79-04088 2B

ESTUARIES
Mixing in Shallow Coastal Sea: Case Study,
W79-04049 5B

Foraminifera, Diatom and Bivalve Distribution in Recent Sediments of the Hudson Estuary,
W79-04056 2L

Turbidity Maxima in Partially Mixed Estuaries: A Two-Dimensional Numerical Model,
W79-04058 2L

A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

Riverine Influence on Estuaries: A Case Study,
W79-04350 2L

Hydraulics in the Coastal Zone.
W79-04351 2L

A Set of Coordinated Mathematical Models for the Coastal Zone,
W79-04353 2L

A Three-Dimensional Numerical Model of Estuarine Circulation,
W79-04354 2L

Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies,
W79-04359 2L

Salinity Distribution of a Highly Stratified Estuary,
W79-04364 2L

Transportation of Organic Detritus in Estuaries,
W79-04388 2L

EURYTEMORA AFFINIS
Carbon Requirements of a Population of the Estuarine Copepod Eurytemora Affinis,
W79-04011 2L

EUTROPHICATION
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

Growth of Fishes During Oligo-, Meso, and Eutrophic Status of Lake Constance (Fischwachstum Bei Oligo-, Meso- und Eutrophie Des Bodensees),
W79-04336 5C

EVALUATION
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

Application of Ion Exchange Membranes to Sampling and Enrichment: Interference of Metal Ion Binding Groups,
W79-04103 1A

Potential Potable-Water Supplies in Redwood National Park,
W79-04393 6D

Idaho's Environment (Problem of Unfettered Exploitation Rights v. Environmental Concern),
W79-04421 5D

Federal Water Pollution Control Act Amendments of 1977 (Seattle, Wash.).
W79-04457 6E

EVAPORATION
Climate, Soil, and Vegetation--4. The Expected Value of Annual Evapotranspiration,
W79-04040 2D

EVAPOTRANSPIRATION
Climate, Soil, and Vegetation--4. The Expected Value of Annual Evapotranspiration,
W79-04040 2D

Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

The Effect of Combined Soil Warming and Irrigation on the Soil Surface Energy Budget,
W79-04490 2G

EXPLOITATION
Idaho's Environment (Problem of Unfettered Exploitation Rights v. Environmental Concern),
W79-04421 5D

EXPLOSIVES
Blasting-It Turns Dry Holes into Wet Ones,
W79-04251 8A

FAIRBANKS AREA
Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska,
W79-04391 2F

FARM MANAGEMENT
Tailoring a Pump for Farm Use,
W79-04245 4A

FEDERAL JURISDICTION
Alaska Oil Discharge Prevention and Pollution Control Act Held Invalid Chevron U.S.A. Inc. v. Hammond,
W79-04424 6E

FEDERAL RECLAMATION LAW
California v. United States (State Restrictions on Federal Appropriation of Water Upheld),
W79-04427 6D

Bureau of Reclamation Required to Comply with California Water Allocation Procedures,
W79-04455 6E

FEDERAL RESERVATIONS
National Forests do not have Reserved Water Rights for Recreational Purposes,
W79-04417 6E

FEDERAL-STATE WATER RIGHTS CONFLICTS
California v. United States (State Restrictions on Federal Appropriation of Water Upheld),
W79-04427 6D

Federal Lands and Consistency: An Intergovernmental Planning Proposal for the Coastal Zone,
W79-04446 6A

United States V. State of New Mexico (Implied Reservation of Water Doctrine Held to Cover Only Amount of Water Necessary for the Purpose of the Reservation).
W79-04453 6E

FEDERAL WATER POLLUTION CONTROL ACT
Section 404 of the Federal Water Pollution Control Act Amendments of 1977: Hydrologic Modification, Wetlands Protection and the Physical Integrity of the Nation's Waters,
W79-04419 5A

E. I. Dupont De Nemours & Co. v. Train - EPA Authority to set Industry Wide Effluent Limitations by Regulation,
W79-04439 6E

Nonpoint Source Pollution,
W79-04443 5A

Federal Water Pollution Control Act Discharge Permit System - An Industrial Viewpoint,
W79-04454 6E

Federal Water Pollution Control Act Amendments of 1977 (Seattle, Wash.).
W79-04457 6E

FEED WATER TREATMENT
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

FERMENTATION
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

FERTILIZERS
A Rational Approach for Optimizing Application Rates of Fertilizer Nitrogen to Reduce Potential Nitrate Pollution of Natural Waters,
W79-04162 5B

Importance of the Organic Phosphorus Fraction in Extracts of Calcareous Soil,
W79-04213 2K

FILTRATION
Tertiary Treatment of Effluents by Filtration,
W79-04279 5D

FINITE-DIFFERENCE MODELS
Transient Pressure Analysis in Geothermal Steam Reservoirs with an Immobile Vaporizing Liquid Phase--Summary Report,
W79-04410 1A

FINITE ELEMENT ANALYSIS
Three-Dimensional Modeling of Groundwater Flow Systems,
W79-04149 2F

FINITE ELEMENT MODEL
A Finite Element Hydrologic Model to Determine the Effect of Land Management Practices on Erosion and Sedimentation in a Watershed,
W79-04091 4D

FINLAND
Upper Layer Observations and Simulation Using Kraus and Turner's Model in the Gulf of Finland,
W79-04045 2L

FISH
Wyoming's Speckled Dace,
W79-04408 5A

FISH BARRIERS
Fish Screening-The State of the Practical Art,
W79-04382 8I

Biological and Engineering Investigation of Angled Flush Fish Diversion Screens,
W79-04383 8I

FISH BEHAVIOR
Movements of Largemouth Bass (Micropterus Salmoides) in Impounded Waters as Determined by Underwater Telemetry,
W79-04016 2H

Aquatic Environmental Analysis in the Lower Yellow-Stone River,
W79-04276 6G

FISH DISEASES
Histopathological and Physiological Responses of Fundulus Heteroclitus to Napthalene Exposure,
W79-04312 5C

FISH EGGS
Toxicity of Cupric Ion to Eggs of the Spot Leiostomus Xanthurus and the Atlantic Silverside Menidia Menidia,
W79-04314 5C

Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

FISH FARMING
Desertification, Development, and the 'Admirals' of Manchar Lake in Sind, Pakistan,
W79-04292 8I

FISH GROWTH
Growth of Fishes During Oligo-, Meso, and Eutrophic Status of Lake Constance (Fischwachstum Bei Oligo-, Meso- und Eutrophie Des Bodensees),
W79-04336 5C

FISH HANDLING FACILITIES
Fish Return Systems,
W79-04381 8I

Fish Screening-The State of the Practical Art,
W79-04382 8I

FISH MANAGEMENT
Desertification, Development, and the 'Admirals' of Manchar Lake in Sind, Pakistan,
W79-04292 8I

FISH PHYSIOLOGY
The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

FISHING
Desertification, Development, and the 'Admirals' of Manchar Lake in Sind, Pakistan,
W79-04292 8I

FLASH FLOODS
Using Satellite Imagery to Detect and Estimate Rainfall from Flash-Flood Producing Thunderstorms,
W79-04072 2B

Record Floods in Southwest Virginia, April 1977.
W79-04153 2E

FLOOD CONTROL
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6E

Urban Flood Management: Problems and Research Needs,
W79-04089 4A

The Disastrous Flood of '78,
W79-04299 2E

Flooding in the Desert - Nature's Paradox,
W79-04300 2A

FLOOD DAMAGE
Record Floods in Southwest Virginia, April 1977.
W79-04153 2E

Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

Floods of July 19-20, 1977, in the Johnstown Area, Western Pennsylvania,
W79-04413 2E

FLOOD DATA
Record Floods in Southwest Virginia, April 1977.
W79-04153 2E

Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

FLOOD FLOW
Record Floods in Southwest Virginia, April 1977.
W79-04153 2E

FLOOD FLOW ROUTING
A Finite Element Hydrologic Model to Determine the Effect of Land Management Practices on Erosion and Sedimentation in a Watershed
W79-04091 4D

FLOOD FORECASTING
Flood Frequency of Small Streams in Alabama,
W79-04024 6A

FLOOD FREQUENCY
Flood Frequency of Small Streams in Alabama,
W79-04024 6A

FLOOD IRRIGATION
Residual Fertilizer Nitrogen in a Flooded Rice Soil,
W79-04237 2G

FLOOD PLAIN INSURANCE
Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

FLOOD PLAIN MANAGEMENT
Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

FLOOD PLAIN ZONING
Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

FLOOD PLAINS
Pope V. City of Atlanta (Act Regulating Construction in River Flood Plain Held Not to Be Unconstitutional Taking of Property Without Compensation).
W79-04452 6E

FLOOD PROFILES
Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

Flood Plain Information: Buxton Creek and Tributaries, Dequincy, Louisiana.
W79-04150 2E

FLOOD PROTECTION
Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

Flooding in the Desert - Nature's Paradox,
W79-04300 2A

FLOOD RECURRENCE INTERVAL
Flood Frequency of Small Streams in Alabama,
W79-04024 6A

Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

FLOOD ROUTING
Muskingum-Cunge Method with Variable Parameters,
W79-04122 2E

The Disastrous Flood of '78,
W79-04299 2B

FLOOD STAGES
Record Floods in Southwest Virginia, April 1977.
W79-04153 2E

Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies,
W79-04359 2L

FLOOD WAVES
Muskingum-Cunge Method with Variable Parameters,
W79-04122 2E

FLOODING
Estimating Peak Discharges in Small Urban Hawaiian Watersheds for Selected Rainfall Frequencies, Kane'ohe Watershed, O'Ahu, Hawaii,
W79-04126 2B

Flood Plain Information: Buxton Creek and Tributaries, Dequincy, Louisiana.
W79-04150 2E

Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

FLOODS
Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

Flooding and Sediment Transport in a Small Alpine Drainage Basin in Colorado,
W79-04090 2J

Record Floods in Southwest Virginia, April 1977.
W79-04153 2E

Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

Floods of July 19-20, 1977, in the Johnstown Area, Western Pennsylvania,
W79-04413 2E

FLORIDA
Limnological Characteristics of Cypress Lake, Upper Kissimmee River Basin, Florida,
W79-04025 2H

Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

Radium-226 in Ground Water of West Central Florida,
W79-04065 5B

A Set of Coordinated Mathematical Models for the Coastal Zone,
W79-04353 2L

Water Levels in Artesian and Nonartesian Aquifers of Florida, 1975-76,
W79-04404 2F

The Legal Significance of the Local Government Comprehensive Plan,
W79-04420 6E

Drawing the Line at the Oceanfront: The Role of Coastal Construction Setback Lines in Regulating Development of the Coastal Zone,
W79-04432 2J

Florida Board of Trustees of the Internal Improvement Trust Fund V. Wakulla Silver Springs Company.
W79-04451 6E

FLORIDAN PLATEAU
Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

FLOTATION
What's New in Flotation. (Quoi de neuf en flottation),
W79-04224 5D

FLOUIRDATION
Commonwealth Department of Environmental Resources V. City of Lebanon (Compulsory Fluoridation Held to Be a Furtherance of Public Health).
W79-04433 5G

FLOW
Flow Patterns Around Submerged Intake Structures for Power Plants,
W79-04356 8A

FLOW CHARACTERISTICS
The Squat Phenomenon and Related Effects of Channel Geometry,
W79-04375 8B

Effects of Ambient Current and Density Stratification on Buoyant Jets,
W79-04387 5B

FLOW PROFILES
The Stability of a Two Layer Flow Without Shear in the Presence of Boundary Generated Turbulence: Field Verification,
W79-04372 8B

FLOW RATES
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

Time of Travel of Solutes in Louisiana Streams,
W79-04401 5B

FLOW SYSTEM
Behavior of a Micro Flowthrough Copper Ion-Selective Electrode System in the Millimolar to Submicromolar Concentration Range,
W79-04102 1A

Appropriation for Instream Flow Maintenance: A Progress Report on 'New' Public Western Water Rights,
W79-04438 6E

FLUMES
New Flume Breakthrough for Ditch Irrigators,
W79-04169 3F

FOAM SEPARATION
Toxicity Removed by Foam Separation,
W79-04254 5D

FOOD CHAINS
Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

FOOD WEBS
Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

FOODS
Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

FORAGE GRASSES
A Neutron Activation Method for Determining Submicrogram Selenium in Forage Grasses,
W79-04235 2I

FORECASTING
Predicting Longitudinal Dispersion of Pollutants in Rivers,
W79-04365 5B

Modeling Dissolved Oxygen in the Near-Field,
W79-04366 5B

FOREST FIRES
Small Mammal Habitat in Different-Aged Chamise-Wedgeleaf Ceanothus Chaparral,
W79-04259 4A

FOREST WATERSHEDS
Big Muddy River Comprehensive Basin Study, Illinois, Summary Report.
W79-04143 6D

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. 1, Main Report.
W79-04146 6G

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. VI: Appendix P - Plan Formulation.
W79-04147 6G

FORESTS
Nitrogen Inputs to Stream Water from Forests Along an Elevational Gradient in New Mexico,
W79-04498 2I

FORMALIN
Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

FORT UNION COAL REGION
Ground Water of the Fort Union Coal Region, Eastern Montana.
W79-04405 5B

FORT WORTH (TX)
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume I.
W79-04135 5D

Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

FOUNDATION INVESTIGATIONS
Design and Analysis of Auburn Dam, Volume Two: Foundation Studies,
W79-04269 8A

FOUR CORNERS AREA
Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

FREQUENCY
Climate, Soil, and Vegetation--2. The Distribution of Annual Precipitation Derived from Observed Storm Sequences,
W79-04038 2B

FRESHWATER FISH
Growth of Fishes During Oligo-, Meso, and Eutrophic Status of Lake Constance (Fischwachstum Bei Oligo-, Meso- und Eutrophie Des Bodensees),
W79-04336 5C

FRESHWATER MARSH
Seasonal Patterns of Nutrient Movement in a Freshwater Tidal Marsh,
W79-04484 2I

FRESHWATER MARSHES
Biomass and Primary Production in Freshwater Tidal Wetlands of the Middle Atlantic Coast,
W79-04485 2I

FURROW IRRIGATION
Distribution Patterns and Losses for Furrow Irrigation,
W79-04181 3F

GAGING STATIONS
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

GALLATING RIVER (MONTANA)
Suspended Solids Carried by the Gallatin River of Southwestern Montana: II. Using Mineralogy for Inferring Sources,
W79-04099 2J

GALVESTON COUNTY
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

GAMMARUS
The Acute Toxicity of Copper to Gammarus Fasciatus Say, A Freshwate Amphipod,
W79-04342 5C

GARTON PUMP
A Hydraulic Model Study of Propeller-Type Lake Destratification Pumps,
W79-04079 2H

GEOCHEMISTRY
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

GEOLOGIC CONTROL
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

GEOLOGY
Ground Water of the Island of Montreal, Canada,
W79-04060 2F

GEOMORPHOLOGY
Hydrologic Parameters from LANDSAT Imagery for Williams Fork Watershed,
W79-04073 5A

A Storage-Routing Model Relating Drainage Basin Hydrology and Geomorphology,
W79-04222 2E

GEOPRESSURED BRINES
Geothermal Goes East,
W79-04248 3C

GEORGIA
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

Pope V. City of Atlanta (Act Regulating Construction in River Flood Plain Held Not to Be Unconstitutional Taking of Property Without Compensation).
W79-04452 6E

GEOTAXIS
Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

GEOTHERMAL STUDIES
Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

Geothermal Goes East,
W79-04248 3C

Drain-Hole Drilling Can Increase Productivity,
W79-04249 8A

Transient Pressure Analysis in Geothermal Steam Reservoirs with an Immobile Vaporizing Liquid Phase--Summary Report,
W79-04410 1A

Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

GERMINATION
A Technique for Assessing Seedling Emergence Under Drought Stress,
W79-04280 3F

GONYAULAX
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

GOVERNMENTAL INTERRELATIONS
Coastal Communities - Partners or Puppets in Outer Continental Shelf Development,
W79-04426 6E

GRAVITY
Gravity-Induced Cross-Formational Flow of Formation Fluids, Red Earth Region, Alberta, Canada: Analysis, Patterns, and Evolution,
W79-04066 2F

GREAT DISMAL SWAMP
Vegetative Communities of the Great Dismal Swamp: Identification and Mapping with Seasonal Color Infrared Photographs,
W79-04018 7B

GREAT LAKES
Corporate Compliance and Compensation Problems in Environmental Protection: Implications of United States v. Reserve Mining Company,
W79-04431 5G

GREAT SALT LAKE
Life in the Great Salt Lake.
W79-04095 2H

GREEN RIVER BASIN (KY)
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

GREEN RIVER (KY)
Green River Data Base System,
W79-04009 4A

GROUND WATER
Heat Pump Update.
W79-04246 5H

GROUNDWATER
External Costs of Land Subsidence in the Houston-Baytown Area,
W79-04015 2F

Water Resources Data for Minnesota, Water Year 1977--Volume 2. Upper Mississippi and Missouri River Basins.
W79-04023 7C

Water in the Skagit River Basin, Washington,
W79-04028 7C

Water Resources Data for Alaska, Water Yea 1977.
W79-04032 7C

Water Resources Data for Minnesota, Water Year 1977--Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W79-04036 7C

Ground Water of the Island of Montreal, Canada,
W79-04060 2F

Radium-226 in Ground Water of West Central Florida,
W79-04065 5B

Determination of Aquifer Diffusivity from Annual Fluctuations of Ground Water Levels,
W79-04069 2F

Finite Element Method for Subsurface Hydrology Using A Mixed Explicit-Implicit Scheme,
W79-04163 2F

The Fresh Water Lens in a Barrier Beach,
W79-04367 2L

Evaluation of a Barrier Against Seawater Intrusion,
W79-04370 2L

Groundwater-Surface Water Relationship Near Lake Michigan Shore,
W79-04371 2H

Potential Potable-Water Supplies in Redwood National Park,
W79-04393 6D

Water Resources Data for California, Water Year 1977--Volume 2. Pacific Slope Basins from Arroyo Grande to Oregon State Line Except Central Valley.
W79-04394 7C

Water Resources Data for California, Water Year 1977--Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.
W79-04395 7C

Water Resources Data for California, Water Year 1977--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W79-04397 7C

Water Resources Data for California, Water Year 1977--Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line.
W79-04398 7C

Ground Water of the Fort Union Coal Region, Eastern Montana.
W79-04405 5B

Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

GROUNDWATER AVAILABILITY
Technology, Regional Interdependence, and Population Growth, Tucson, Arizona,
W79-04307 6B

Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska,
W79-04391 2F

Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

GROUNDWATER BASINS
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

GROUNDWATER DIVIDE
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

GROUNDWATER FLOW
Gravity-Induced Cross-Formational Flow of Formation Fluids, Red Earth Region, Alberta, Canada: Analysis, Patterns, and Evolution,
W79-04066 2F

GROUNDWATER MOVEMENT
Convective Contaminant Transport to Pumping Well,
W79-04022 5B

Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

Gravity-Induced Cross-Formational Flow of Formation Fluids, Red Earth Region, Alberta, Canada: Analysis, Patterns, and Evolution,
W79-04066 2F

Three-Dimensional Modeling of Groundwater Flow Systems,
W79-04149 2F

Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska,
W79-04391 2F

The Use of Bounding Wells to Counteract the Effects of Gravity in Dipping Aquifers,
W79-04496 4B

GROUNDWATER RECHARGE
Artificial Recharge: Part II,
W79-04239 4B

GROUNDWATER RESOURCES
Hydrologic Evaluation of Part of Central Volusia County, Florida,
W79-04030 4B

Water Resources of Camas Prairie, South-Central Idaho,
W79-04031 2F

Water Levels in Artesian and Nonartesian Aquifers of Florida, 1975-76,
W79-04404 2F

GROWTH RATE
Salinity Effects on Growth and Toxin Content of Gonyaulax Excavata, A Marine Dinoflagellate Causing Paralytic Shellfish Poisoning,
W79-04313 5B

GROWTH RATES
Microbial Growth on Hydrocarbons -- Some Experimental Results,
W79-04101 5A

GULF COAST
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

GULF OF FINLAND
Upper Layer Observations and Simulation Using Kraus and Turner's Model in the Gulf of Finland,
W79-04045 2L

GULLIES
Rocky Bottom Fauna in a Submarine Gulley at Loppkalven, Finnmark, Northern Norway,
W79-04057 2L

GUPPIES
Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

HABITATS
Small Mammal Habitat in Different-Aged Chamise-Wedgeleaf Ceanothus Chaparral,
W79-04259 4A

HARBORS
Major Port Improvement Alternatives,
W79-04376 8B

HCB
Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton,
W79-04318 5C

HEAT PUMPS
Ground-Heat-Assisted Heat Pumps,
W79-04243 8C

Heat Pump Update.
W79-04246 6B

HEAT TRANSFER
Turbulent Transport to a Rotating Cylinder,
W79-04486 3A

HEAVY METALS
The Complexing and Adsorption of Cadmium in Soils in the Presence of EDTA and NTA,
W79-04007 5B

Contents of Some Heavy Metals in Norwegian Rivers,
W79-04021 5A

Copper and Cadmium Adsorption Characteristics of Selected Acid and Calcareous Soils,
W79-04210 2K

HERBICIDES
Aquatic Herbicides,
W79-04476 4A

HERONS
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

HETEROPNEUSTES
Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

HEXACHLOROBENZENE
Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

HIGHWAY EFFECTS
To Solve Highway and Farm Water Management Problems,
W79-04190 4C

HILL (NH)
Hill Reestablishment: Retrospective Community Study of a Relocated New England Town,
W79-04158 6B

HISTORY
Historical Profile of Quality of Water Laboratories and Activities, 1879--1973,
W79-04034 7B

Land Tenure, Hazards, and the Economy: Viticulture in the Mendoza Oasis, Argentina,
W79-04291 3F

HOUSTON-BAYTOWN
External Costs of Land Subsidence in the Houston-Baytown Area,
W79-04015 2F

HOUSTON (TX)
Stormwater Analysis and Prediction in Houston,
W79-04052 5B

HUDSON ESTUARY
Foraminifera, Diatom and Bivalve Distribution in Recent Sediments of the Hudson Estuary,
W79-04056 2L

HUDSON RIVER
Foraminifera, Diatom and Bivalve Distribution in Recent Sediments of the Hudson Estuary,
W79-04056 2L

HYDRAULIC CONDUCTIVITY
On Oscillation of Numerical Solution of a Modified Richards' Equation,
W79-04231 2G

HYDRAULIC DESIGN
Spillway Stilling Basin for Low Froude Flows,
W79-04355 8B

HYDRAULIC GRADIENT
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

HYDRAULIC MODELS
Spillway Stilling Basin for Low Froude Flows,
W79-04355 8B

HYDRAULIC STRUCTURES
Flow Patterns Around Submerged Intake Structures for Power Plants,
W79-04356 8A

Improved Drag Force Linearizations for Structural Dynamic Calculations,
W79-04358 8B

Diffraction of Waves by A Shore-Connected Breakwater,
W79-04377 8B

Fish Return Systems,
W79-04381 8I

Fish Screening-The State of the Practical Art,
W79-04382 8I

Biological and Engineering Investigation of Angled Flush Fish Diversion Screens,
W79-04383 8I

HYDRAULIC SYSTEMS
Fish Return Systems,
W79-04381 8I

HYDRAULICS
Hydraulics in the Coastal Zone.
W79-04351 2L

Tidal Jet Flows Near Inlets,
W79-04361 2L

Some Practical Techniques of Two-Dimensional Interpolation in Computational Hydraulics,
W79-04368 8B

On Numerical Accuracy in Computational Hydraulics,
W79-04369 8B

The Squat Phenomenon and Related Effects of Channel Geometry,
W79-04375 8B

HYDROELECTRIC POWER
A Nonlinear Programming Algorithm for Real-Time Hourly Reservoir Operations,
W79-04482 6B

HYDROGEN ION CONCENTRATION
A Model of the Behavior of pH Determining Parameters in Impoundments,
W79-04064 5B

The Distribution of Micronutrient Cations in Soil Under Conditions of Varying Redox Potential and pH,
W79-04214 2K

HYDROGRAPHS
Identification and Separation of Major Base Flow Components from a Stream Hydrograph,
W79-04067 2E

HYDROLOGIC DATA
Water Resources Data for Minnesota, Water Year 1977--Volume 2. Upper Mississippi and Missouri River Basins.
W79-04023 7C

Hydrologic Data for Soldier Creek Basin, Kansas,
W79-04026 7C

Water Resources Data for Alaska, Water Year 1977.
W79-04032 7C

Water Resources Data for Minnesota, Water Year 1977--Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W79-04036 7C

Status of the National Water Data Exchange (NAWDEX)--September 1978,
W79-04392 10A

Water Resources Data for California, Water Year 1977--Volume 2. Pacific Slope Basins from Arroyo Grande to Oregon State Line Except Central Valley.
W79-04394 7C

Water Resources Data for California, Water Year 1977--Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.
W79-04395 7C

Water Resources Data for California, Water Year 1977--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W79-04397 7C

Water Resources Data for California, Water Year 1977--Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line.
W79-04398 7C

HYDROLOGIC MODELS
Hydrologic and Water Quality Modeling of Surface Water Discharges from Mining Operations,
W79-04134 6A

HYDROLOGIC SYSTEMS
Section 404 of the Federal Water Pollution Control Act Amendments of 1977: Hydrologic Modification, Wetlands Protection and the Physical Integrity of the Nation's Waters,
W79-04419 5A

HYDROLOGY
A Storage-Routing Model Relating Drainage Basin Hydrology and Geomorphology,
W79-04222 2E

ICE COVER
The Effect of Ice Cover on Vertical Tranfer in Stream Channels,
W79-04062 2E

IDAHO
Idaho's Environment (Problem of Unfettered Exploitation Rights v. Environmental Concern),
W79-04421 5D

ILLINOIS
The Additive and Interactive Effects of Powerlessness and Anomie in Predicting Opposition to Pollution Control,
W79-04010 5G

An Assessment of Water Quality in the Spoon River, Part 2,
W79-04047 5A

An Assessment of Water Quality in the Spoon River, Part 1,
W79-04048 5A

Wells and Ponds: Water Quality and Supply,
W79-04068 3C

Groundwater-Surface Water Relationship Near Lake Michigan Shore,
W79-04371 2H

Freeland v. Dickson (Lower Landowner has no Right to Unimpeded Flow of Surface Water onto his Land),
W79-04434 2F

IMPERIAL DIVISION (7)
Report on Imperial Division (7) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04106 6B

IMPOUNDED WATERS
Movements of Largemouth Bass (Micropterus Salmoides) in Impounded Waters as Determined by Underwater Telemetry,
W79-04016 2H

The Economic Impact of Increased Forest and Farmland Beaver Damage in Mississippi,
W79-04074 2H

INDEXING
Status of the National Water Data Exchange (NAWDEX)--September 1978,
W79-04392 10A

Index to Water-Resources Data for Louisiana, Ground-Water Records,
W79-04412 7C

INDIA
A Case for Reappraisal of Indian Water Pollution Standards as Applicable to Pulp and Paper Industry,
W79-04255 6E

INDUCED PRECIPITATION
Precipitation Management and the Environment, an Overview of the Skywater IX Conference.
W79-04157 2B

INDUSTRIAL WASTES
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

Toxicity of Textile Waste to Some Teleost Fishes,
W79-04341 5C

Corporate Compliance and Compensation Problems in Environmental Protection: Implications of United States v. Reserve Mining Company,
W79-04431 5G

Apparatus and Process for Treating Contaminated Water,
W79-04477 5D

Method and Apparatus for Treating Metal Containing Waste Water,
W79-04478 5D

INFILTRATION
Effect of Entrapped Soil Air on Infiltration,
W79-04124 2G

The Dependence of the Parameters in the Green and Ampt Infiltration Equation on the Initial Water Content in Draining and Wetting States,
W79-04155 2G

A Kinematic Model for Surface Irrigation,
W79-04230 2G

INFORMATION EXCHANGE
Status of the National Water Data Exchange (NAWDEX)--September 1978,
W79-04392 10A

INFORMATION RETRIEVAL
Status of the National Water Data Exchange (NAWDEX)--September 1978,
W79-04392 10A

INFRARED IMAGERY
Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

INHIBITION
Spectrophotometricaly Assayed Inhibitory Effects of Mercuric Compounds on Anabaena Flos-Aquae and Anacystis Nidulans (Cyanophyceae),
W79-04327 5A

JECTION WELLS
Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

Waste Surveillance in Subsurface Disposal Projects,
W79-04097 5E

The Use of Bounding Wells to Counteract the Effects of Gravity in Dipping Aquifers,
W79-04496 4B

LETS (WATERWAYS)
Comparison of Numerical Simulation Flow Models for Coastal Inlets,
W79-04352 2L

Tidal Jet Flows Near Inlets,
W79-04361 2L

Minimizing Wave Transmission Through Jettied Inlets,
W79-04363 2H

A Generalized Point-Velocity Method for Discharge Computations in Tidal Waterways,
W79-04378 2L

SECTICIDES
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

SECTS
A Record of Palaeodipteron Walkeri Ide (Diptera: Nymphomyiidae) from Maine: A Species and Family New to the United States,
W79-04265 6G

STITUTIONAL CONSTRAINTS
Electric Power Development in the Pacific Northwest Region: Institutional Commitments and Alternatives, Phase 2,
W79-04159 6E

STITUTIONS
Institutional Aspects of Water Resources Management at Substate Level,
W79-04309 6E

STRUMENTATION
An Acoustic Probe for Precise Determination of Deep Water Levels in Boreholes,
W79-04241 7B

TAKES STRUCTURES
Flow Patterns Around Submerged Intake Structures for Power Plants,
W79-04356 8A

Intake Screenwell Surging Caused by Wave Dynamics,
W79-04357 8A

Biological and Engineering Investigation of Angled Flush Fish Diversion Screens,
W79-04383 8I

TERBASIN TRANSFERS
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

TERMITTENT STREAMS
Wyoming's Speckled Dace,
W79-04408 5A

TERNATIONAL COMMISSIONS
Liability for Oil Pollution Under the Merchant Shipping (Oil Pollution) Act 1971,
W79-04425 6E

TERTIDAL AREAS
Influence of Domestic Wastes on Energetic Pathways in Rocky Intertidal Communities,
W79-04133 5C

INVERTEBRATES
Environmental Effects of Western Coal Surface Mining, Part II: The Aquatic Macroinvertebrates of Trout Creek, Colorado,
W79-04252 5C

ION EXCHANGE
Application of Ion Exchange Membranes to Sampling and Enrichment: Interference of Metal Ion Binding Groups,
W79-04103 1A

Use of K/Rb Ratio to Characterize Potassium Uptake by Plant Roots Growing in Soil,
W79-04206 2I

Physico-Chemical Techniques for Treating Mill Effluents: A State-of-the-Art Review,
W79-04256 5D

IONS
Behavior of a Micro Flowthrough Copper Ion-Selective Electrode System in the Millimolar to Submicromolar Concentration Range,
W79-04102 1A

IRRIGATION
Obtaining Specifications for Minimum Cost Irrigation Systems,
W79-04012 6A

Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

Station Timing Selection Circuit for Irrigation Controller,
W79-04462 3F

Rotary Spraying Device Particularly Useful for Water Irrigation,
W79-04466 3F

Drip Irrigation Emitter,
W79-04467 3F

Means and Method of Installing Emitters in Irrigation Tubing,
W79-04475 3F

IRRIGATION DESIGN
Effects of Planting Configuration on Water Use and Economics of Drip Irrigation Systems,
W79-04302 3F

IRRIGATION DITCHES
New Flume Breakthrough for Ditch Irrigators,
W79-04169 3F

IRRIGATION EFFECTS
Water Resources of Camas Prairie, South-Central Idaho,
W79-04031 2F

Effect of Salinity on Agriculture in Iraq,
W79-04173 3F

Responses of Several Forage and Field Crops to Subsurface Soil Warming and Sewage Effluent Spray Irrigation,
W79-04489 3F

The Effect of Combined Soil Warming and Irrigation on the Soil Surface Energy Budget,
W79-04490 2G

IRRIGATION EFFICIENCY
Tensiometers Teach how to Save Fuel and Water,
W79-04165 3F

New Mexico Pump Study Points to Farmers' Need for Efficiency Knowledge.
W79-04166 3F

Basic Irrigation Scheduling Procedures,
W79-04171 3F

Effect of Irrigation Regime on Maize Yields,
W79-04174 3F

Nonuniform Sprinkler Irrigation Application Efficiency,
W79-04176 3F

On-Farm Level-Basin Irrigation--Save Water and Energy,
W79-04177 3F

Distribution Patterns and Losses for Furrow Irrigation,
W79-04181 3F

Describing Irrigation Efficiency and Uniformity,
W79-04183 3F

Float Valves Improve Pipeline Systems,
W79-04184 3F

Better Water Use, Say Texans,
W79-04191 3F

Computer Scheduling Can Save More Water,
W79-04198 3F

Standards for the Calculation of Irrigation Efficiencies,
W79-04201 3F

Effects of Planting Configuration on Water Use and Economics of Drip Irrigation Systems,
W79-04302 3F

Water Economy and Saline Water Use by Drip Irrigation,
W79-04303 3F

Value of Drip Irrigation Compared with Conventional Irrigation for Vegetable Production in a Hot Arid Climate,
W79-04304 3F

Drip Irrigation Emitter,
W79-04467 3F

IRRIGATION PRACTICES
Tailwater Pits Gain Popularity in Texas,
W79-04170 3F

How Idaho Irrigators Trim Back Power Costs,
W79-04186 3F

Limited Irrigation Tests Get Results,
W79-04187 3F

Disintegration of a Traditional Resource-Use Complex: The Otomi of the Mezquital Valley, Hidalgo, Mexico,
W79-04293 6G

Water Economy and Saline Water Use by Drip Irrigation,
W79-04303 3F

Value of Drip Irrigation Compared with Conventional Irrigation for Vegetable Production in a Hot Arid Climate,
W79-04304 3F

Station Timing Selection Circuit for Irrigation Controller,
W79-04462 3F

Drip Irrigation Emitter,
W79-04467 3F

Economically Optimum Irrigation Patterns for Grain Sorghum Production: Texas High Plains,
W79-04495 3F

IRRIGATION PROGRAMS
Irrigation Management Service and Mosquito Control,
W79-04175 3F

IRRIGATION SCHEDULES
Irrigation Water Movement Below the Corn Root Zone in Crete Silt Loam,
W79-04483 2G

IRRIGATION SYSTEMS
Irrigate--A Scheduling Model,
W79-04188 3F

Development of Agricultural Irrigation in the Federal Republic of Germany,
W79-04194 3F

Drip Irrigation-Chemical, Physical Ways to Keep Emitters Open,
W79-04196 3F

Computer Scheduling Can Save More Water,
W79-04198 3F

A Winning Battle Against Destruction,
W79-04284 3F

Effects of Planting Configuration on Water Use and Economics of Drip Irrigation Systems,
W79-04302 3F

IRRIGATION WATER
Transient Changes in the Soil-Water System from Irrigation with Saline Water: I. Theory,
W79-04202 2G

Transient Changes in the Soil-Water System from Irrigation with Saline Water: II. Analysis of Experimental Data,
W79-04205 2G

ISRAEL
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

JETS
Effects of Ambient Current and Density Stratification on Buoyant Jets,
W79-04387 5B

JETTIES
Minimizing Wave Transmission Through Jettied Inlets,
W79-04363 2H

JOJOBA
Growth and Yield of Jojoba Plants in Native Stands Using Runoff-Collecting Microcatchments,
W79-04288 3F

JUDICIAL DECISIONS
National Forests do not have Reserved Water Rights for Recreational Purposes,
W79-04417 6E

E. I. Dupont De Nemours & Co. v. Train - EPA Authority to set Industry Wide Effluent Limitations by Regulation,
W79-04439 6E

State Law, Not Federal, Determines Riparian Rights to Accretions,
W79-04450 6E

Federal Water Pollution Control Act Discharge Permit System - An Industrial Viewpoint,
W79-04454 6E

Bureau of Reclamation Required to Comply with California Water Allocation Procedures,
W79-04455 6E

KAOLINITE
Phosphate Desorption from Kaolinite Suspensions,
W79-04207 2K

KENTUCKY
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

Green River Data Base System,
W79-04009 4A

LABORATORIES
Historical Profile of Quality of Water Laboratories and Activities, 1879--1973,
W79-04034 7B

LABORATORY EQUIPMENT
A Large-Volume Interstitial Water Sediment Squeezer for Lake Sediments,
W79-04098 2J

LABORATORY TESTS
Transportation of Organic Detritus in Estuaries,
W79-04388 2L

LAGUNA DIVISION (8)
Report on Laguna Division (8) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04107 6B

LAKE
Desertification, Development, and the 'Admirals' of Manchar Lake in Sind, Pakistan,
W79-04292 8I

LAKE CHAMPLAIN
Sedimentation Rates in Lake Champlain Since Settlement by Man,
W79-04308 2J

LAKE CONSTANCE
Growth of Fishes During Oligo-, Meso, and Eutrophic Status of Lake Constance (Fischwachstum Bei Oligo-, Meso- und Eutrophie Des Bodensees),
W79-04336 5C

LAKE ERIE
Elutriate-Primary Productivity Bioassays of Dredge Spoil Disposal in Lake Erie,
W79-04329 5B

LAKE MICHIGAN
Minimizing Wave Transmission Through Jettied Inlets,
W79-04363 2H

Groundwater-Surface Water Relationship Near Lake Michigan Shore,
W79-04371 2H

LAKE MORPHOLOGY
Limnological Characteristics of Cypress Lake, Upper Kissimmee River Basin, Florida,
W79-04025 2H

Desertification, Development, and the 'Admirals' of Manchar Lake in Sind, Pakistan,
W79-04292 8I

LAKE SEDIMENTS
A Large-Volume Interstitial Water Sediment Squeezer for Lake Sediments,
W79-04098 2J

LAKE SHORES
Groundwater-Surface Water Relationship Near Lake Michigan Shore,
W79-04371 2H

LAKES
Fossil Pigments in Minnesota Lake Sediments and Their Bearing Upon the Balance between Terrestrial and Aquatic Inputs to Sedimentary Organic Matter,
W79-04129 2H

LAMINAR FLOW
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

LAND DEVELOPMENT
The Legal Significance of the Local Government Comprehensive Plan,
W79-04420 6E

LAND MANAGEMENT
Perspectives on Desertification,
W79-04282 3F

Desertification of The Great Plains: Will it Happen,
W79-04285 2A

LAND RECLAMATION
Perspectives on Desertification,
W79-04282 3F

LAND SUBSIDENCE
External Costs of Land Subsidence in the Houston-Baytown Area,
W79-04015 2F

LAND TENURE
Land Tenure, Hazards, and the Economy: Viticulture in the Mendoza Oasis, Argentina,
W79-04291 3F

LAND USE
Institutional Aspects of Water Resources Management at Substate Level,
W79-04309 6E

Productive Land Use of Dredged Material Containment Areas,
W79-04385 5E

LANDSAT
Hydrologic Parameters from LANDSAT Imagery for Williams Fork Watershed,
W79-04073 5A

LARGEMOUTH BASS
Movements of Largemouth Bass (Micropterus Salmoides) in Impounded Waters as Determined by Underwater Telemetry,
W79-04016 2H

LAW OF THE SEA
Floating Nuclear Plants - A 'Reasonable Use' o the High Seas,
W79-04436 6E

Conservation and the New Informal Composite Negotiating Text of the Law of the Sea Conference,
W79-04440 6E

Balancing the Interests. The Third Un-Law o the Sea Conference - (7th Session),
W79-04441 6E

Development of the Hard Mineral Resources o the Deep Seabed.
W79-04458 6E

LEACHING
Atrazine Mobility in Two Soils Under Conventional Tillage,
W79-04212 2G

Retention and Leaching of Nutrients in a Limed Ultisol Under Cropping,
W79-04500 5E

LEAD
Alteration in the Activities of Three Peptidase and Lipase in the Digestive System of the Fish Channa Punctatus Exposed to Lead Nitrate,
W79-04345 5C

EGAL ASPECTS
Multiple Use of Irrigation Canals,
W79-04096 6D

208 Water Quality Planning How it Will Affect You,
W79-04193 6E

EGISLATION
Progress of Protection of the Environment and Resources in the United States-A Historical Survey,
W79-04278 6E

Alaska Oil Discharge Prevention and Pollution Control Act Held Invalid Chevron U.S.A. Inc. v. Hammond,
W79-04424 6E

EIOSTOMUS
Toxicity of Cupric Ion to Eggs of the Spot Leiostomus Xanthurus and the Atlantic Silverside Menidia Menidia,
W79-04314 5C

IME
Retention and Leaching of Nutrients in a Limed Ultisol Under Cropping,
W79-04500 5B

IME-MAGNESIUM CARBONATE ROCESSES
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

IMNOLOGY
Limnological Characteristics of Cypress Lake, Upper Kissimmee River Basin, Florida,
W79-04025 2H

A Large-Volume Interstitial Water Sediment Squeezer for Lake Sediments,
W79-04098 2J

INEAR PROGRAMMING
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

ININGS
Asphalt-Crumb Rubber Waterproofing Membrane,
W79-04182 8G

ITTLE RIVER (TX)
Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

OCAL GOVERNMENT
Notes on California's Coastal Governance: A Reply to Peter Douglas,
W79-04444 6A

OCAL GOVERNMENTS
Coastal Communities - Partners or Puppets in Outer Continental Shelf Development,
W79-04426 6E

OUISIANA
Flood Plain Information: Buxton Creek and Tributaries, Dequincy, Louisiana.
W79-04150 2E

A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

Diffusion of Dredged Material in the Mississippi River,
W79-04384 5B

Time of Travel of Solutes in Louisiana Streams,
W79-04401 5B

Index to Water-Resources Data for Louisiana, Ground-Water Records,
W79-04412 7C

LOW-FLOW AUGMENTATION
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

LOYALHANNA CREEK RESERVOIR
A Model of the Behavior of pH Determining Parameters in Impoundments,
W79-04064 5B

MACOMB COUNTY (MI)
Macomb County Area of Particular Concern Inventory.
W79-04148 6G

MAGNESIUM CARBONATE
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

MAGNETIC TAPE
Hydrologic Data for Soldier Creek Basin, Kansas,
W79-04026 7C

MAMMALS
Small Mammal Habitat in Different-Aged Chamise-Wedgeleaf Ceanothus Chaparral,
W79-04259 4A

MANAGEMENT
Which Way to the Beach. Public Access to Beaches for Recreational Use,
W79-04435 6E

MANOMETRIC METHOD OF BOD
Let's Upgrade the BOD Test,
W79-04277 5A

MAPPING
Vegetative Communities of the Great Dismal Swamp: Identification and Mapping with Seasonal Color Infrared Photographs,
W79-04018 7B

Desertification of Arid Lands,
W79-04287 2A

MARINE BIOLOGY
Foraminifera, Diatom and Bivalve Distribution in Recent Sediments of the Hudson Estuary,
W79-04056 2L

MARKOV PROCESSES
A Mathematical Model of Monthly Flow Sequences,
W79-04054 2E

MARYLAND
Carbon Requirements of a Population of the Estuarine Copepod Eurytemora Affinis,
W79-04011 2L

Twelfth Annual Report, Program Activities, July 1, 1975-June 30, 1976.
W79-04117 10F

Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

Non-Point Source Pollution Studies in the Chincoteague Bay System,
W79-04488 5B

MASONBORO INLET (NC)
Comparison of Numerical Simulation Flow Models for Coastal Inlets,
W79-04352 2L

MASS TRANSFER
Mass Transfer in Nonuniform Packing,
W79-04127 8G

Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

Turbulent Transport to a Rotating Cylinder,
W79-04486 3A

MATHEMATICAL MODELS
Climate, Soil, and Vegetation--6. Dynamics of the Annual Water Balance,
W79-04042 2A

A Mathematical Model of Monthly Flow Sequences,
W79-04054 2E

Muskingum-Cunge Method with Variable Parameters,
W79-04122 2E

Three-Dimensional Modeling of Groundwater Flow Systems,
W79-04149 2F

A Method for Parameter Sensitivity Analysis in Differential Equation Models,
W79-04229 6A

A Set of Coordinated Mathematical Models for the Coastal Zone,
W79-04353 2L

Improved Drag Force Linearizations for Structural Dynamic Calculations,
W79-04358 8B

Non-Point Source Pollution Studies in the Chincoteague Bay System,
W79-04488 5B

MATHEMATICAL STUDIES
The Dependence of the Parameters in the Green and Ampt Infiltration Equation on the Initial Water Content in Draining and Wetting States,
W79-04155 2G

On Oscillation of Numerical Solution of a Modified Richards' Equation,
W79-04231 2G

Some Practical Techniques of Two-Dimensional Interpolation in Computational Hydraulics,
W79-04368 8B

On Numerical Accuracy in Computational Hydraulics,
W79-04369 8B

MAXIMUM PROBABLE FLOOD
Record Floods in Southwest Virginia, April 1977.
W79-04153 2E

MEANDERS
Florida Board of Trustees of the Internal Improvement Trust Fund V. Wakulla Silver Springs Company.
W79-04451 6E

MEASUREMENT
Some Errors in Precipitation Measurements,
W79-04088 2B

An Acoustic Probe for Precise Determination of Deep Water Levels in Boreholes,
W79-04241 7B

MEASUREMENTS
Viability Measurements on Activated Sludge,
W79-04006 5D

MEDITERRANEAN SEA
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

MELT WATER
Water in the Skagit River Basin, Washington,
W79-04028 7C

MEMBRANES
Application of Ion Exchange Membranes to Sampling and Enrichment: Interference of Metal Ion Binding Groups,
W79-04103 1A

MENIDIA
Toxicity of Cupric Ion to Eggs of the Spot Leiostomus Xanthurus and the Atlantic Silverside Menidia Menidia,
W79-04314 5C

MERCURY
Behavior and Transport of Mercury in River-Reservoir System Downstream of Inactive Chloralkali Plant,
W79-04290 5C

Spectrophotometricaly Assayed Inhibitory Effects of Mercuric Compounds on Anabaena Flos-Aquae and Anacystis Nidulans (Cyanophyceae),
W79-04327 5A

Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5B

MERCURY COMPOUNDS
Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5B

METEOROLOGY
The Effects of Rain Gage Densities on the Analysis of Storm Total Rainfall from Convective Complexes,
W79-04108 2B

METHANE BACTERIA
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

METHODOLOGY
Hydrologic Data for Soldier Creek Basin, Kansas,
W79-04026 7C

METHYLMERCURY
Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5B

MICHIGAN
Macomb County Area of Particular Concern Inventory.
W79-04148 6G

MICROBIAL DEGRADATION
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

MICROCATCHMENTS
Growth and Yield of Jojoba Plants in Native Stands Using Runoff-Collecting Microcatchments,
W79-04288 3F

MICROORGANISMS
Carbon Requirements of a Population of the Estuarine Copepod Eurytemora Affinis,
W79-04011 2L

Bacterial Metabolism of Arylsulfonates: Role of Meta Cleavage in Benzene Sulfonate Oxidation by Pseudomonas Testosteroni,
W79-04013 5D

Microbial Growth on Hydrocarbons -- Some Experimental Results,
W79-04101 5A

MIDDLE ATLANTIC BIGHT
The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

MINE DRAINAGE
Hydrologic and Water Quality Modeling of Surface Water Discharges from Mining Operations,
W79-04134 6A

MINERALOGY
Suspended Solids Carried by the Gallatin River of Southwestern Montana: II. Using Mineralogy for Inferring Sources,
W79-04099 2J

MINING
Development of the Hard Mineral Resources of the Deep Seabed.
W79-04458 6E

MINNESOTA
Water Resources Data for Minnesota, Water Year 1977--Volume 2. Upper Mississippi and Missouri River Basins.
W79-04023 7C

Water Resources Data for Minnesota, Water Year 1977--Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W79-04036 7C

MISSISSIPPI RIVER
Diffusion of Dredged Material in the Mississippi River,
W79-04384 5B

MISSOURI RIVER BASIN
Water Resources Data for Minnesota, Water Year 1977--Volume 2. Upper Mississippi and Missouri River Basins.
W79-04023 7C

MIXING
Mixing in Shallow Coastal Sea: Case Study,
W79-04049 5B

The Effect of Ice Cover on Vertical Tranfer in Stream Channels,
W79-04062 2E

MODEL STUDIES
A Cross-Sectional Investigation of the Determinants of Urban Residential Water Demand in the United States, 1960 and 1970,
W79-04003 6D

Climate, Soil, and Vegetation--1. Introduction to Water Balance Dynamics,
W79-04037 2A

Climate, Soil, and Vegetation--3. A Simplified Model of Soil Moisture Movement in the Liquid Phase,
W79-04039 2G

Climate, Soil, and Vegetation--4. The Expected Value of Annual Evapotranspiration,
W79-04040 2D

Climate, Soil, and Vegetation--5. A Derived Distribution of Storm Surface Runoff,
W79-04041 2E

Climate, Soil, and Vegetation--6. Dynamics of the Annual Water Balance,
W79-04042 2A

Climate, Soil, and Vegetation--7. A Derived Distribution of Annual Water Yield,
W79-04043 2A

Upper Layer Observations and Simulation Using Kraus and Turner's Model in the Gulf of Finland,
W79-04045 2L

Mixing in Shallow Coastal Sea: Case Study,
W79-04049 5B

Projecting Urban Runoff Flows and Loads,
W79-04050 5B

A Mathematical Model of Monthly Flow Sequences,
W79-04054 2E

Turbidity Maxima in Partially Mixed Estuaries: A Two-Dimensional Numerical Model,
W79-04058 2L

Mean Upwelling Velocities on the Oregon Continental Shelf During Summer 1973,
W79-04059 2L

The Effect of Ice Cover on Vertical Tranfer in Stream Channels,
W79-04062 2E

A Model of the Behavior of pH Determining Parameters in Impoundments,
W79-04064 5B

Identification and Separation of Major Base Flow Components from a Stream Hydrograph,
W79-04067 2E

Determination of Aquifer Diffusivity from Annual Fluctuations of Ground Water Levels
W79-04069 2F

A Finite Element Aquifer Model Which Takes Into Account Elevation Changes of the Aquifer
W79-04083 2F

A Unified Approach to Watershed Modelling
W79-04084 2A

An Iterative Quasi-Three-Dimensional Finite Element Model for Heterogeneous Multiaquifer Systems,
W79-04125 2F

Finite Element Method for Subsurface Hydrology Using A Mixed Explicit-Implicit Scheme
W79-04163 2F

A Storage-Routing Model Relating Drainage Basin Hydrology and Geomorphology,
W79-04222 2E

Comparison of Numerical Simulation Flow Models for Coastal Inlets,
W79-04352 2L

A Three-Dimensional Numerical Model of Estuarine Circulation,
W79-04354 2L

Flow Patterns Around Submerged Intake Structures for Power Plants,
W79-04356 8A

Intake Screenwell Surging Caused by Wave Dynamics,
W79-04357 8A

Tidal Jet Flows Near Inlets,
W79-04361 2L

Wave Runup on Irregular Beach Profiles,
W79-04362 2L

Minimizing Wave Transmission Through Jettied Inlets,
W79-04363 2H

Salinity Distribution of a Highly Stratified Estuary,
W79-04364 2L

The Fresh Water Lens in a Barrier Beach,
W79-04367 2L

Velocity Distribution and Sediment Motion Induced by Ship's Propeller in Ship Channels,
W79-04374 8B

Diffraction of Waves by A Shore-Connected Breakwater,
W79-04377 8B

A Generalized Point-Velocity Method for Discharge Computations in Tidal Waterways,
W79-04378 2L

Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

Biological and Engineering Investigation of Angled Flush Fish Diversion Screens,
W79-04383 8I

Experimental Studies of Beach Scour Due to Wave Action,
W79-04386 2L

Effects of Ambient Current and Density Stratification on Buoyant Jets,
W79-04387 5B

Transportation of Organic Detritus in Estuaries,
W79-04388 2L

Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

Transient Pressure Analysis in Geothermal Steam Reservoirs with an Immobile Vaporizing Liquid Phase--Summary Report,
W79-04410 1A

Testing Social Indicators in the Techcom Model for Water Development,
W79-04491 6A

Economically Optimum Irrigation Patterns for Grain Sorghum Production: Texas High Plains,
W79-04495 3F

MODEL TESTS
Application of a Version of the Stanford Model to a Small Piedmont Watershed,
W79-04086 2A

MOINA MACROCOPA
Cladoceran Survival Studies in a Kraft Pulp Mill Aerated Stabilization Basin,
W79-04111 5D

MOISTURE STRESS
A Technique for Assessing Seedling Emergence Under Drought Stress,
W79-04280 3F

MOMENTUM TRANSFER
Turbulent Transport to a Rotating Cylinder,
W79-04486 3A

MONITORING
Marine Receiving Water Monitoring Program for Pulp Mill Effluent (Of Canadian Cellulose Co. Ltd.) at Prince Rupert,
W79-04416 5A

MONOSODIUM METHANEARSONATE
Distribution of Arsenic in Soil Profiles After Repeated Applications of MSMA,
W79-04085 5B

MONTANA
Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

Ground Water of the Fort Union Coal Region, Eastern Montana.
W79-04405 5B

MONTREAL ISLAND (QUEBEC)
Ground Water of the Island of Montreal, Canada,
W79-04060 2F

MORTALITY
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

Acutely Lethal Levels of Cadmium, Copper, and Zinc to Adult Male Coho Salmon and Steelhead,
W79-04340 5C

MOSQUITOES
Irrigation Management Service and Mosquito Control,
W79-04175 3F

MULTIPLE-PURPOSE RESERVOIRS
Interim Report, South Umpqua River. Volume II, Appendix A: Economic Data and Analysis.
W79-04140 6C

Interim Report, South Umpqua River. Volume IV, Appendices E Through J, Reports of Coordinating Agencies.
W79-04141 6G

MUNICIPAL WASTEWATER
Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

MUNICIPAL WATER
A Cross-Sectional Investigation of the Determinants of Urban Residential Water Demand in the United States, 1960 and 1970,
W79-04003 6D

NAPHTHALENE
Histopathological and Physiological Responses of Fundulus Heteroclitus to Napthalene Exposure,
W79-04312 5C

NARROGUAGUS RIVER (MAINE)
A Record of Palaeodipteron Walkeri Ide (Diptera: Nymphomyiidae) from Maine: A Species and Family New to the United States,
W79-04265 6G

NATIONAL FORESTS
National Forests do not have Reserved Water Rights for Recreational Purposes,
W79-04417 6E

United States V. State of New Mexico (Implied Reservation of Water Doctrine Held to Cover Only Amount of Water Necessary for the Purpose of the Reservation).
W79-04453 6E

NATIONAL PARKS
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

Potential Potable-Water Supplies in Redwood National Park,
W79-04393 6D

NATIONAL WATER DATA EXCHANGE (NAWDEX)
Status of the National Water Data Exchange (NAWDEX)--September 1978,
W79-04392 10A

NATURAL FLOW
Freeland v. Dickson (Lower Landowner has no Right to Unimpeded Flow of Surface Water onto his Land),
W79-04434 2F

NATURAL RESOURCES
Accomplishment Plan, Region VIII. Comprehensive Energy-Environment Program.
W79-04137 6E

NAVIGATION
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

Velocity Distribution and Sediment Motion Induced by Ship's Propeller in Ship Channels,
W79-04374 8B

The Squat Phenomenon and Related Effects of Channel Geometry,
W79-04375 8B

Major Port Improvement Alternatives,
W79-04376 8B

NEGOTIATIONS
Conservation and the New Informal Composite Negotiating Text of the Law of the Sea Conference,
W79-04440 6E

Balancing the Interests. The Third Un-Law of the Sea Conference - (7th Session),
W79-04441 6E

Development of the Hard Mineral Resources of the Deep Seabed.
W79-04458 6E

NETWORKS
Topological Classifications of Drainage Networks: An Evaluation,
W79-04232 2A

NEUTRON ACTIVATION ANALYSIS
A Neutron Activation Method for Determining Submicrogram Selenium in Forage Grasses,
W79-04235 2I

NEW HAMPSHIRE
Robbins v. Lake Ossipee Village, Inc. (Beach Use and Right-of-Way Resevations in Deed Upheld).
W79-04437 6E

NEW JERSEY
Mixing in Shallow Coastal Sea: Case Study,
W79-04049 5B

Distribution of Autotrophic Nitrifying Bacteria in a Polluted River (The Passaic),
W79-04070 5B

The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

American Dredging Company v. State Department of Environmental Protection (Order Banning Dumping of Dredge Soil in Protected Wetlands Area Upheld),
W79-04415 5G

NEW MEXICO
United States V. State of New Mexico (Implied Reservation of Water Doctrine Held to Cover Only Amount of Water Necessary for the Purpose of the Reservation).
W79-04453 6E

NEW ORLEANS (LA)
Diffusion of Dredged Material in the Mississippi River,
W79-04384 5B

NEW YORK
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

NITRATES
Disposition of 15N-Labeled Fertilizer Nitrate Applied During Corn Culture in Field Lysimeters,
W79-04223 3F

The Automatic Determination of ppb Levels of Ammonia, Nitrate Plus Nitrite, and Phosphate in Water in the Presence of Added Mercury (II) Chloride,
W79-04226 2K

NITRIFICATION
Investigation of the Long-Term Effects of Chlorine on the Oxygen Demand of Wastewaters,
W79-04160 5D

Inhibition of Urease Activity by Heterocyclic Sulfur Compounds,
W79-04233 2K

NITRIFYING BACTERIA
Distribution of Autotrophic Nitrifying Bacteria in a Polluted River (The Passaic),
W79-04070 5B

NITROGEN
A Rational Approach for Optimizing Application Rates of Fertilizer Nitrogen to Reduce Potential Nitrate Pollution of Natural Waters,
W79-04162 5B

Residual Fertilizer Nitrogen in a Flooded Rice Soil,
W79-04237 2G

Nitrogen Inputs to Stream Water from Forests Along an Elevational Gradient in New Mexico,
W79-04498 2I

NOMADISM
Water Control and Desertification, the Resettled Nomads of Deh Luran, Iran,
W79-04306 6A

NON-POINT POLLUTION
Non-Point Pollution and the SCS,
W79-04197 6E

NON-POINT SOURCES
Effects of Non-Point Pollution on Benthic Invertebrates in the Lynnhaven River System,
W79-04071 5C

NON-STRUCTURAL ALTERNATIVES
Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

NONLINEAR PROGRAMMING
Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

NONLINEAR SYSTEMS
Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

NORTH CAROLINA
Comparison of Numerical Simulation Flow Models for Coastal Inlets,
W79-04352 2L

NORTH DAKOTA
Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

NORTH RIGBY IRRIGATION DISTRICT
Obtaining Specifications for Minimum Cost Irrigation Systems,
W79-04012 6A

NORTHERN CENTRAL VALLEY BASINS
Water Resources Data for California, Water Year 1977--Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line.
W79-04398 7C

NORWAY
Contents of Some Heavy Metals in Norwegian Rivers,
W79-04021 5A

Rocky Bottom Fauna in a Submarine Gulley at Loppkalven, Finnmark, Northern Norway,
W79-04057 2L

NORWEGIAN RIVERS
Contents of Some Heavy Metals in Norwegian Rivers,
W79-04021 5A

NUCLEAR POWERPLANTS
Floating Nuclear Plants - A 'Reasonable Use' of the High Seas,
W79-04436 6E

NUMERICAL ANALYSIS
Some Practical Techniques of Two-Dimensional Interpolation in Computational Hydraulics,
W79-04368 8B

On Numerical Accuracy in Computational Hydraulics,
W79-04369 8B

NUTRIENT REMOVAL
The Distribution of Micronutrient Cations in Soil Under Conditions of Varying Redox Potential and pH,
W79-04214 2K

NUTRIENTS
Seasonal Patterns of Nutrient Movement in a Freshwater Tidal Marsh,
W79-04484 2I

OBSERVATIONS WELLS
Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

OCEANS
Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

Floating Nuclear Plants - A 'Reasonable Use' of the High Seas,
W79-04436 6E

Development of the Hard Mineral Resources of the Deep Seabed.
W79-04458 6E

OHIO
Citizens' Committee to Preserve Lake Logan v. Williams (State Agency's Maintenance of Water Quality Through Control of Effluents Found too Strict),
W79-04430 5D

Huelsmann V. State (Recovery Denied for Loss of Well Water Caused by Highway Construction).
W79-04456 2F

OIL
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

Acute Toxicity of the Water-Soluble Fraction of Cook Inlet Crude Oil to the Manila Clam,
W79-04323 5C

OIL POLLUTION
The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

Alaska Oil Discharge Prevention and Pollution Control Act Held Invalid Chevron U.S.A. Inc. v. Hammond,
W79-04424 6E

Liability for Oil Pollution Under the Merchant Shipping (Oil Pollution) Act 1971,
W79-04425 6E

Oil-Water Separator,
W79-04461 5G

Settling Tank,
W79-04474 5D

Method of Removing Oil from Water,
W79-04479 5D

OIL SPILLS
Firth of Forth Oil Pollution Incident, February 1978,
W79-04316 5B

Liability for Oil Pollution Under the Merchant Shipping (Oil Pollution) Act 1971,
W79-04425 6E

OILY WATER
Method of Resolving a Mixture of Oil, Water and Solids,
W79-04471 5D

Method of Removing Oil from Water,
W79-04479 5D

ON-SITE INVESTIGATIONS
Mixing in Shallow Coastal Sea: Case Study,
W79-04049 5B

The Stability of a Two Layer Flow Without Shear in the Presence of Boundary Generated Turbulence: Field Verification,
W79-04372 8B

ON-SITE TESTS
Prototype Reaeration Measurements, Beltzville Dam, Pennsylvania,
W79-04380 5G

OPEN CHANNEL FLOW
Modification of the Chezy Roughness Coefficient by Density Stratification,
W79-04373 8B

OPERATION AND MAINTENANCE
Experience with the Operation of an Effluent Clarifier (Experience d'operation d'un clarificateur d'effluents),
W79-04305 5D

OPHIOCEPHALUS
In Vivo Effect of Endrin on Three Phosphatases in Kidney and Liver of the Fish Ophiocephalus Punctatus,
W79-04333 5C

OPTIMIZATION
Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

A Nonlinear Programming Algorithm for Real-Time Hourly Reservoir Operations,
W79-04482 6B

OREGON
Mean Upwelling Velocities on the Oregon Continental Shelf During Summer 1973,
W79-04059 2L

Energy and Water Resources.
W79-04112 6D

Planning for Proper Use of Land and Water.
W79-04113 6A

Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies,
W79-04359 2L

OREGON COAST WATERS
Mean Upwelling Velocities on the Oregon Continental Shelf During Summer 1973,
W79-04059 2L

ORGANIC MATTER
The Distribution of Micronutrient Cations in Soil Under Conditions of Varying Redox Potential and pH,
W79-04214 2K

Extractability of 238Pu and 242Cm from a Contaminated Soil as a Function of pH and Certain Soil Components: HNO3-NaOH System,
W79-04236 2G

ORGANIC WASTES
Update: What's in the Water.
W79-04242 5F

Water Purification with Fragmented Oil Shale,
W79-04465 5D

ORGANIZATIONS
Twelfth Annual Report, Program Activities, July 1, 1975-June 30, 1976.
W79-04117 10F

OUTDOOR RECREATION
Big Muddy River Comprehensive Basin Study, Illinois, Vol. 7, Appendix M and N.
W79-04144 6D

OVERLAND FLOW
Salt Pickup by Overland Flow in the Price River Basin, Utah,
W79-04298 2E

OXIDATION LAGOONS
Wastewater Treatment for Small Rural Communities,
W79-04119 5D

OYSTERS
Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

PACIFIC COAST REGION
Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies,
W79-04359 2L

PACIFIC SLOPE BASINS
Water Resources Data for California, Water Year 1977--Volume 2. Pacific Slope Basins from Arroyo Grande to Oregon State Line Except Central Valley.
W79-04394 7C

Water Resources Data for California, Water Year 1977--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W79-04397 7C

PACKED BEDS
Mass Transfer in Nonuniform Packing,
W79-04127 8G

PALAEODIPTERON WALKERI IDE
A Record of Palaeodipteron Walkeri Ide (Diptera: Nymphomyiidae) from Maine: A Species and Family New to the United States,
W79-04265 6G

PALEOHYDROLOGY
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

PALM OIL
Efficiency of Canal Biodegradation of Palm Oil Sludge and Its Pollution Effects,
W79-04332 5D

PARAMECIUM
The Effect of Temperature on Copper Tolerance of Paramecium,
W79-04343 5C

PARR
Toxicities of Cadmium, Copper, and Zinc to Four Juvenile Stages of Chinook Salmon and Steelhead,
W79-04339 5C

PASSAIC RIVER (NJ)
Distribution of Autotrophic Nitrifying Bacteria in a Polluted River (The Passaic),
W79-04070 5B

PATENTS
Water Sampling Bucket,
W79-04459 7B

Water Purifying System and Pump Therefor,
W79-04460 5F

Oil-Water Separator,
W79-04461 5G

Station Timing Selection Circuit for Irrigation Controller,
W79-04462 3F

Method for the Purification of Sewage Waters Which Contain Organic Compounds of an Anionic Nature,
W79-04463 5D

Organic Waste Drying Process,
W79-04464 5D

Water Purification with Fragmented Oil Shale,
W79-04465 5D

Rotary Spraying Device Particularly Useful for Water Irrigation,
W79-04466 3F

Drip Irrigation Emitter,
W79-04467 3F

Power Generation and Potable Water Recovery from Salinous Water,
W79-04468 3A

Electrolytic Cell for Treatment of Water,
W79-04469 5F

Process for Treating Sewage, Particularly on Ships,
W79-04470 5D

Method of Resolving a Mixture of Oil, Water, and Solids,
W79-04471 5D

Sea Water Desalinization System,
W79-04472 3A

Sewage Treatment System,
W79-04473 5D

Settling Tank,
W79-04474 5D

Means and Method of Installing Emitters in Irrigation Tubing,
W79-04475 3F

Aquatic Herbicides,
W79-04476 4A

Apparatus and Process for Treating Contaminated Water,
W79-04477 5D

Method and Apparatus for Treating Metal Containing Waste Water,
W79-04478 5D

Method of Removing Oil from Water,
W79-04479 5D

Simultaneous Treatment of SO2 Containing Stack Gases and Waste Water,
W79-04480 5D

Septic System Liquid Level Control Apparatus,
W79-04481 5D

PATH OF POLLUTANTS
The Complexing and Adsorption of Cadmium in Soils in the Presence of EDTA and NTA,
W79-04007 5B

Experimental Evaluation of Chemical Transport in Water-Saturated Porous Media: 2. Sorbing Media,
W79-04014 5A

Convective Contaminant Transport to Pumping Well,
W79-04022 5B

Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

Simazine Residues in Canal Water and Crops Resulting from Experimental Application for Ditchbank Weed Control,
W79-04267 5B

Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5B

Time of Travel of Solutes in Louisiana Streams,
W79-04401 5B

PATHOGENIC BACTERIA
Further Studies on Bifidobacteria as Indicators of Faecal Pollution in Water,
W79-04328 5A

Relationship Between Indicator Organisms and Selected Pathogenic Bacteria in Urban Waterways,
W79-04330 5A

PATUXENT RIVER
Carbon Requirements of a Population of the Estuarine Copepod Eurytemora Affinis,
W79-04011 2L

PEACE RIVER
Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

PEAK DISCHARGE
Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

Estimating Peak Discharges in Small Urban Hawaiian Watersheds for Selected Rainfall Frequencies, Kane'ohe Watershed, O'Ahu, Hawaii,
W79-04126 2B

Flood Plain Information: Buxton Creek and Tributaries, Dequincy, Louisiana.
W79-04150 2E

Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

Floods of July 19-20, 1977, in the Johnstown Area, Western Pennsylvania,
W79-04413 2E

PENNSYLVANIA
Projecting Urban Runoff Flows and Loads,
W79-04050 5B

Unit Sediment Graph,
W79-04172 2J

Prototype Reaeration Measurements, Beltzville Dam, Pennsylvania,
W79-04380 5G

Effectiveness of Sediment-Control Techniques used During Highway Construction in Central Pennsylvania,
W79-04403 4D

Floods of July 19-20, 1977, in the Johnstown Area, Western Pennsylvania,
W79-04413 2E

Commonwealth Department of Environmental Resources V. City of Lebanon (Compulsory Fluoridation Held to Be a Furtherance of Public Health).
W79-04433 5G

PERCOLATING WATER
Huelsmann V. State (Recovery Denied for Loss of Well Water Caused by Highway Construction).
W79-04456 2F

PERENNIAL STREAMS
Wyoming's Speckled Dace,
W79-04408 5A

PERMEABILITY
Hydraulic and Electro-Osmotic Permeability Coefficients,
W79-04092 2F

PERMITS
California v. United States (State Restrictions on Federal Appropriation of Water Upheld),
W79-04427 6D

PESTICIDE KINETICS
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

PESTICIDE RESIDUES
Simazine Residues in Canal Water and Crops Resulting from Experimental Application for Ditchbank Weed Control,
W79-04267 5B

Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

PESTICIDE TOXICITY
Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton,
W79-04318 5C

In Vivo Effect of Endrin on Three Phosphatases in Kidney and Liver of the Fish Ophiocephalus Punctatus,
W79-04333 5C

PETROCHEMICALS
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

PHOSPHATE DEPOSITS
Radium-226 in Ground Water of West Central Florida,
W79-04065 5B

PHOSPHATES
Radium-226 in Ground Water of West Central Florida,
W79-04065 5B

Phosphate Desorption from Kaolinite Suspensions,
W79-04207 2K

The Automatic Determination of ppb Levels of Ammonia, Nitrate Plus Nitrite, and Phosphate in Water in the Presence of Added Mercury (II) Chloride,
W79-04226 2K

PHOSPHORUS
Greenhouse Evaluation of Residual Phosphate by Four Phosphorus Methods in Neutral and Calcareous Soils,
W79-04178 2K

Prediction of Phosphorus Diffusion from Fertilizer Source,
W79-04208 2K

Importance of the Organic Phosphorus Fraction in Extracts of Calcareous Soil,
W79-04213 2K

Sodium Bicarbonate Extraction to Estimate Nitrogen, Phosphorus, and Potassium Availability in Soils,
W79-04238 2G

PHOTOGRAMMETRY
Channel Erosion Surveys Along the Tap Route, Alaska 1977,
W79-04411 2J

PHOTOTAXIS
Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

PHYTOPLANKTON
Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton
W79-04318 5C

PIGEON LAKE (MI)
Minimizing Wave Transmission Through Jettied Inlets,
W79-04363 2H

PIGMENTS
Fossil Pigments in Minnesota Lake Sediments and Their Bearing Upon the Balance between Terrestrial and Aquatic Inputs to Sedimentary Organic Matter,
W79-04129 2H

PIPELINES
Channel Erosion Surveys Along the Tap Route, Alaska 1977,
W79-04411 2J

PIPES
Irrigation Piep Repair Cuts Costs,
W79-04185 8A

PLANNING
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

Planning for Proper Use of Land and Water
W79-04113 6A

Upper Trinity River Basin Comprehensive Sewerage Plan, Volume I.
W79-04135 5D

Interim Report, South Umpqua River. Volume I: Main Report.
W79-04139 4D

Interim Report, South Umpqua River. Volume II, Appendix A: Economic Data and Analysis
W79-04140 6C

Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. 1, Main Report
W79-04146 6G

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. VI: Appendix P - Plan Formulation.
W79-04147 6G

Planning for Water Resources,
W79-04152 6D

Perspectives on Desertification,
W79-04282 3F

Access to the Nation's Beaches: Legal and Planning Perspectives,
W79-04448 6A

PLASTIC PIPES
Ground-Heat-Assisted Heat Pumps,
W79-04243 8C

POLITICAL CONSTRAINTS
Perspectives on Desertification,
W79-04282 3F

Water Control and Desertification, the Resettled Nomads of Deh Luran, Iran,
W79-04306 6A

POLLUTANTS
Contents of Some Heavy Metals in Norwegian Rivers,
W79-04021 5A

Convective Contaminant Transport to Pumping Well,
W79-04022 5B

Projecting Urban Runoff Flows and Loads,
W79-04050 5B

June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

Predicting Longitudinal Dispersion of Pollutants in Rivers,
W79-04365 5B

POLLUTION ABATEMENT
Corporate Compliance and Compensation Problems in Environmental Protection: Implications of United States v. Reserve Mining Company,
W79-04431 5G

The Use of Civil Penalties in Enforcing the Clean Water Act Amendments of 1977,
W79-04449 6E

POLYCHAETES
Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

POLYCHLORINATED BIPHENYLS
Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

POMPANO BEACH AREA
Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

PONDS
Wells and Ponds: Water Quality and Supply,
W79-04068 3C

The Economic Impact of Increased Forest and Farmland Beaver Damage in Mississippi,
W79-04074 2H

Water Quality Improvement in Small Ponds,
W79-04261 5G

POPE COUNTY (IL)
Wells and Ponds: Water Quality and Supply,
W79-04068 3C

POROUS MEDIA
Hydraulic and Electro-Osmotic Permeability Coefficients,
W79-04092 2F

POTABLE WATER
EPA Proposed Far-Reaching Regulations for Reducing Synthetic Organics in Drinking Water.
W79-04422 5F

POTASSIUM
Use of K/Rb Ratio to Characterize Potassium Uptake by Plant Roots Growing in Soil,
W79-04206 2I

Potassium and Rubidium Adsorption and Diffusion in Soil,
W79-04216 2K

A New Approach to Soil Testing: III. Differential Adsorption of Potassium,
W79-04227 2K

Sodium Bicarbonate Extraction to Estimate Nitrogen, Phosphorus, and Potassium Availability in Soils,
W79-04238 2G

PRE-TREATMENT (WATER)
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

PRECIPITATION
Precipitation Management and the Environment, an Overview of the Skywater IX Conference.
W79-04157 2B

PRECIPITATION (ATMOSPHERIC)
Water in the Skagit River Basin, Washington,
W79-04028 7C

Climate, Soil, and Vegetation--2. The Distribution of Annual Precipitation Derived from Observed Storm Sequences,
W79-04038 2B

Reservoir Sedimentation as a Function of Precipitation Variability,
W79-04061 4D

Some Errors in Precipitation Measurements,
W79-04088 2B

PRECIPITATION VARIABILITY
Reservoir Sedimentation as a Function of Precipitation Variability,
W79-04061 4D

PRESCRIPTIVE RIGHTS
State v. Beach Company (Sporadic, Recreation use of Private Beachfront Land not Sufficient to Create Public Easement to Beach).
W79-04429 2J

PRESSES
The Filter Belt Press -- Application and Design,
W79-04286 5D

PRIMARY PRODUCTION
Biomass and Primary Production in Freshwater Tidal Wetlands of the Middle Atlantic Coast,
W79-04485 2I

PRIMARY PRODUCTIVITY
Elutriate-Primary Productivity Bioassays of Dredge Spoil Disposal in Lake Erie,
W79-04329 5B

PRINCE GEORGES COUNTY
Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

PRIOR APPROPRIATION
Appropriation for Instream Flow Maintenance: A Progress Report on 'New' Public Western Water Rights,
W79-04438 6E

PROGRAMMING LANGUAGES
Fortran IV Program to Compute Diversity Indices from Information Theory,
W79-04262 10D

Fortran IV Program to Compute Replicated Diversity Indices for Random Samples of Specified Size,
W79-04263 10D

Fortran IV Program to Compute Hierarchical Diversity,
W79-04264 10D

PROJECT POST-EVALUATION
A Winning Battle Against Destruction,
W79-04284 3F

PROTEINS
Analysis of Practicability of a Solution to the Problem of Pollution by Spent Liquors (Analyse de practicabilite d'une solution au probleme de la pollution par les liqueurs residuelles),
W79-04400 5D

PROTOZOA
The Effect of Temperature on Copper Tolerance of Paramecium,
W79-04343 5C

PROVIDENCE RIVER (RI)
A Three-Dimensional Numerical Model of Estuarine Circulation,
W79-04354 2L

PSEUDOMONAS AERUGINOSA
Microbial Growth on Hydrocarbons -- Some Experimental Results,
W79-04101 5A

PUBLIC ACCESS
Who Owns Our Beaches,
W79-04418 6E

State v. Beach Company (Sporadic, Recreation use of Private Beachfront Land not Sufficient to Create Public Easement to Beach).
W79-04429 2J

Which Way to the Beach. Public Access to Beaches for Recreational Use,
W79-04435 6E

Access to the Nation's Beaches: Legal and Planning Perspectives,
W79-04448 6A

PUBLIC HEALTH
Salinity Effects on Growth and Toxin Content of Gonyaulax Excavata, A Marine Dinoflagellate Causing Paralytic Shellfish Poisoning,
W79-04313 5B

Commonwealth Department of Environmental Resources V. City of Lebanon (Compulsory Fluoridation Held to Be a Furtherance of Public Health).
W79-04433 5G

PUBLIC MEETINGS
Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

PUBLIC PARTICIPATION
Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

Perceptions of Effective Public Participation in Water Resources Decision Making and Their Relationship to Levels of Participation,
W79-04493 6B

PUBLIC RIGHTS
Access to the Nation's Beaches: Legal and Planning Perspectives,
W79-04448 6A

PUEBLO (CO)
Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

PUERTO RICO
Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

PULP AND PAPER INDUSTRY
A Case for Reappraisal of Indian Water Pollution Standards as Applicable to Pulp and Paper Industry,
W79-04255 6E

Physico-Chemical Techniques for Treating Mill Effluents: A State-of-the-Art Review,
W79-04256 5D

PULP WASTES
Cladoceran Survival Studies in a Kraft Pulp Mill Aerated Stabilization Basin,
W79-04111 5D

Escanaba's Environmental Systems: The First Five Years,
W79-04219 5D

Limiting the Costs of Pollution Control: Treatment of Effluents at the Source (Limitation du cout de la depollution: traitement des effluents a la source),
W79-04221 5D

What's New in Flotation. (Quoi de neuf en flottation),
W79-04224 5D

A Study of the Fate of Suspended Solids from a Full-Scale Treatment Plant in Receiving Waters,
W79-04225 5B

Toxicity Removed by Foam Separation,
W79-04254 5D

Physico-Chemical Techniques for Treating Mill Effluents: A State-of-the-Art Review,
W79-04256 5D

Enso-Biox Method for Deodorization and Detoxification of Waste Waters,
W79-04295 5D

Experience with the Operation of an Effluent Clarifier (Experience d'operation d'un clarificateur d'effluents),
W79-04305 5D

Analysis of Practicability of a Solution to the Problem of Pollution by Spent Liquors (Analyse de practicabilite d'une solution au probleme de la pollution par les liqueurs residuelles),
W79-04400 5D

Marine Receiving Water Monitoring Program for Pulp Mill Effluent (Of Canadian Cellulose Co. Ltd.) at Prince Rupert,
W79-04416 5A

Washing of Unbleached Kraft Pulp with Effluents (Promyvka sul'fatnoi nebelenoi tsellyulozy stochnymi vodami),
W79-04423 3E

PUMP TESTING
New Mexico Pump Study Points to Farmers' Need for Efficiency Knowledge.
W79-04166 3F

PUMPING
Convective Contaminant Transport to Pumping Well,
W79-04022 5B

Water Resources of Camas Prairie, South-Central Idaho,
W79-04031 2F

PUMPS
New Mexico Pump Study Points to Farmers' Need for Efficiency Knowledge.
W79-04166 3F

Tailoring a Pump for Farm Use,
W79-04245 4A

QUESTIONNAIRES
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

RADIOACTIVITY
Extractability of 238Pu and 242Cm from a Contaminated Soil as a Function of pH and Certain Soil Components: HNO3-NaOH System,
W79-04236 2G

RADIUM
Radium-226 in Ground Water of West Central Florida,
W79-04065 5B

RAIN GAGES
Some Errors in Precipitation Measurements,
W79-04088 2B

Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

RAINBOW TROUT
The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5B

RAINFALL
A Unified Approach to Watershed Modelling,
W79-04084 2A

The Effects of Rain Gage Densities on the Analysis of Storm Total Rainfall from Convective Complexes,
W79-04108 2B

Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

RAINFALL INTENSITY
Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

RAINFALL-RUNOFF RELATIONSHIPS
Estimating Peak Discharges in Small Urban Hawaiian Watersheds for Selected Rainfall Frequencies, Kane'ohe Watershed, O'Ahu, Hawaii,
W79-04126 2B

A Rainfall Simulator for Field Studies of Runoff and Soil Erosion,
W79-04289 2B

RANGELAND
Erosion Prediction on California Rangeland: Research Developments and Needs,
W79-04487 4D

RATIONING (WATER)
Water Systems and Their Emergencies,
W79-04497 6B

REAERATION
A Hydraulic Model Study of Propeller-Type Lake Destratification Pumps,
W79-04079 2H

Prototype Reaeration Measurements, Beltzville Dam, Pennsylvania,
W79-04380 5G

RECLAMATION
Bureau of Reclamation Required to Comply with California Water Allocation Procedures,
W79-04455 6E

RECREATION
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

Multiple Use of Irrigation Canals,
W79-04096 6D

Report on Cibola Division (6) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04105 6B

Report on Imperial Division (7) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04106 6B

Report on Laguna Division (8) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04107 6B

RECREATION DEMAND
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

REDWOOD NATIONAL PARK
Potential Potable-Water Supplies in Redwood National Park,
W79-04393 6D

REFLECTANCE
Earth-Atmosphere Systems and Surface Reflectivities in Arid Regions from LANDSAT MSS Data,
W79-04297 2A

REGIONAL ANALYSIS
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume I.
W79-04135 5D

Resettlement and Desertification: The Wagogo of Dodoma District, Tanzania,
W79-04296 6A

Technology, Regional Interdependence, and Population Growth, Tucson, Arizona,
W79-04307 6B

REGIONAL DEVELOPMENT
Electric Power Development in the Pacific Northwest Region: Institutional Commitments and Alternatives, Phase 2,
W79-04159 6E

Technology, Regional Interdependence, and Population Growth, Tucson, Arizona,
W79-04307 6B

REGIONAL ECONOMICS
Big Muddy River Comprehensive Basin Study, Illinois, Vol. 7, Appendix M and N.
W79-04144 6D

Agriculture: Its Historic and Contemporary Roles in Arizona's Economy,
W79-04281 6D

REGIONAL FLOOD
Record Floods in Southwest Virginia, April 1977.
W79-04153 2E

REGIONAL PLANNING
Accomplishment Plan, Region VIII. Comprehensive Energy-Environment Program.
W79-04137 6E

Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

South Platte River Basin Accomplishment Plan.
W79-04145 5G

REGIONS
Big Muddy River Comprehensive Basin Study, Illinois, Summary Report.
W79-04143 6D

REGULATION
Update: What's in the Water.
W79-04242 5F

RELOCATION
Hill Reestablishment: Retrospective Community Study of a Relocated New England Town,
W79-04158 6B

REMOTE SENSING
Vegetative Communities of the Great Dismal Swamp: Identification and Mapping with Seasonal Color Infrared Photographs,
W79-04018 7B

Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

Using Satellite Imagery to Detect and Estimate Rainfall from Flash-Flood Producing Thunderstorms,
W79-04072 2B

Earth-Atmosphere Systems and Surface Reflectivities in Arid Regions from LANDSAT MSS Data,
W79-04297 2A

Channel Erosion Surveys Along the Taps Route, Alaska 1977,
W79-04411 2J

RESEARCH PRIORITIES
Dredged Material Research Program, Fourth Annual Report.
W79-04044 6G

RESERVATION DOCTRINE
National Forests do not have Reserved Water Rights for Recreational Purposes,
W79-04417 6E

United States V. State of New Mexico (Implied Reservation of Water Doctrine Held to Cover Only Amount of Water Necessary for the Purpose of the Reservation).
W79-04453 6E

RESERVOIR LEAKAGE
Asphalt-Crumb Rubber Waterproofing Membrane,
W79-04182 8G

RESERVOIR MANAGEMENT
Green River Data Base System,
W79-04009 4A

RESERVOIR OPERATION DATA
Green River Data Base System,
W79-04009 4A

RESERVOIR OPERATIONS
A Nonlinear Programming Algorithm for Real-Time Hourly Reservoir Operations,
W79-04482 6B

RESERVOIR SEDIMENTATION
Reservoir Sedimentation as a Function of Precipitation Variability,
W79-04061 4D

RESERVOIRS
Reservoir Sedimentation as a Function of Precipitation Variability,
W79-04061 4D

A Model of the Behavior of pH Determining Parameters in Impoundments,
W79-04064 5B

Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

RESETTLEMENT
Resettlement and Desertification: The Wagogo of Dodoma District, Tanzania,
W79-04296 6A

RESOURCE ALLOCATION
Who Owns Our Beaches,
W79-04418 6E

RESOURCE DEVELOPMENT
Federal Lands and Consistency: An Intergovernmental Planning Proposal for the Coastal Zone,
W79-04446 6A

RESOURCES DEVELOPMENT
Coastal Communities - Partners or Puppets in Outer Continental Shelf Development,
W79-04426 6E

Water Allocation: Constraints and Opportunities,
W79-04442 6E

RETURN FLOW
Effect of Salinity on Agriculture in Iraq,
W79-04173 3F

REVIEWS
Fish Screening-The State of the Practical Art,
W79-04382 8I

RHODE ISLAND
The Fresh Water Lens in a Barrier Beach,
W79-04367 2L

RIBIDIUM
Potassium and Rubidium Adsorption and Diffusion in Soil,
W79-04216 2K

RICE
Residual Fertilizer Nitrogen in a Flooded Rice Soil,
W79-04237 2G

RIPARIAN LAND
State Law, Not Federal, Determines Riparian Rights to Accretions,
W79-04450 6E

RIPARIAN RIGHTS
State Law, Not Federal, Determines Riparian Rights to Accretions,
W79-04450 6E

RIPARIAN WATERS
Appropriation for Instream Flow Maintenance: A Progress Report on 'New' Public Western Water Rights,
W79-04438 6E

RISKS
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

Land Tenure, Hazards, and the Economy: Viticulture in the Mendoza Oasis, Argentina,
W79-04291 3F

RIVER BASIN DEVELOPMENT
Interim Report, South Umpqua River. Volume I: Main Report.
W79-04139 4D

Big Muddy River Comprehensive Basin Study, Illinois, Summary Report.
W79-04143 6D

Big Muddy River Comprehensive Basin Study, Illinois, Vol. 7, Appendix M and N.
W79-04144 6D

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. 1, Main Report.
W79-04146 6G

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. VI: Appendix P - Plan Formulation.
W79-04147 6G

RIVER FLOW
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

RIVER STAGES
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

RIVERS
Trace Metal Relationships in Bottom Sediments of a Fresh Water Stream--The Buffalo River, Arkansas,
W79-04017 2J

Contents of Some Heavy Metals in Norwegian Rivers,
W79-04021 5A

An Assessment of Water Quality in the Spoon River, Part 2,
W79-04047 5A

An Assessment of Water Quality in the Spoon River, Part 1,
W79-04048 5A

Predicting Longitudinal Dispersion of Pollutants in Rivers,
W79-04365 5B

ROAD CONSTRUCTION
Effectiveness of Sediment-Control Techniques used During Highway Construction in Central Pennsylvania,
W79-04403 4D

ROCKY MOUNTAIN NATIONAL PARK
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

ROOT SYSTEMS
Use of K/Rb Ratio to Characterize Potassium Uptake by Plant Roots Growing in Soil,
W79-04206 2I

Water Uptake by Plants: I. Divided Root Experiments,
W79-04348 2I

Water Uptake by Plants: II. The Root Contact Model,
W79-04349 2I

ROTIFERS
Development and Assessment of Acute Bioassay Techniques for the Littoral Rotifer, Philodina acuticornis,
W79-04120 5A

ROUGHNESS COEFFICIENT
Modification of the Chezy Roughness Coefficient by Density Stratification,
W79-04373 8B

RUNOFF
Trace Elements in Runoff from Rainfall and Snowmelt at Several Localities in the Denver, Colorado, Metropolitan Area,
W79-04019 5B

Climate, Soil, and Vegetation--5. A Derived Distribution of Storm Surface Runoff,
W79-04041 2E

A Unified Approach to Watershed Modelling,
W79-04084 2A

Growth and Yield of Jojoba Plants in Native Stands Using Runoff-Collecting Microcatchments,
W79-04288 3F

A Rainfall Simulator for Field Studies of Runoff and Soil Erosion,
W79-04289 2B

Nitrogen Inputs to Stream Water from Forests Along an Elevational Gradient in New Mexico,
W79-04498 2I

RURAL SOCIOLOGY
Disintegration of a Traditional Resource-Use Complex: The Otomi of the Mezquital Valley, Hidalgo, Mexico,
W79-04293 6G

Resettlement and Desertification: The Wagogo of Dodoma District, Tanzania,
W79-04296 6A

SACRAMENTO RIVER BASIN
Water Resources Data for California, Water Year 1977--Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line.
W79-04398 7C

SAFE YIELD
Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

SAINE WATER INTRUSION
Evaluation of a Barrier Against Seawater Intrusion,
W79-04370 2L

SAINT-VENANT EQUATIONS
Finite Element Solution of Saint-Venant Equations,
W79-04100 10D

SALINE LAKES
Life in the Great Salt Lake,
W79-04095 2H

SALINE WATER
Transient Changes in the Soil-Water System from Irrigation with Saline Water: I. Theory,
W79-04202 2G

Transient Changes in the Soil-Water System from Irrigation with Saline Water: II. Analysis of Experimental Data,
W79-04205 2G

Effects of Evaporative Salt Water Cooling Towers on Salt Drift and Salt Deposition on Surrounding Soils,
W79-04220 5B

Salt Pickup by Overland Flow in the Price River Basin, Utah,
W79-04298 2E

SALINE WATER BARRIERS
Evaluation of a Barrier Against Seawater Intrusion,
W79-04370 2L

SALINE WATER INTRUSION
Hydrologic Evaluation of Part of Central Volusia County, Florida,
W79-04030 4B

Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

SALINITY
Effect of Salinity on Agriculture in Iraq,
W79-04173 3F

Salinity Effects on Growth and Toxin Content of Gonyaulax Excavata, A Marine Dinoflagellate Causing Paralytic Shellfish Poisoning,
W79-04313 5B

The Influence of Salinity on Toxicity of Cadmium and Chromium to the Blue Crab, Callinectes Sapidus,
W79-04319 5C

Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

Salinity Distribution of a Hignly Stratified Estuary,
W79-04364 2L

SAMPLING
An Assessment of Water Quality in the Spoon River, Part 2,
W79-04047 5A

An Assessment of Water Quality in the Spoon River, Part 1,
W79-04048 5A

Water Sampling Bucket,
W79-04459 7B

SAN PATRICIO COUNTY
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

SATELLITE IMAGERY
Using Satellite Imagery to Detect and Estimate Rainfall from Flash-Flood Producing Thunderstorms,
W79-04072 2B

SATELLITES (ARTIFICIAL)
Using Satellite Imagery to Detect and Estimate Rainfall from Flash-Flood Producing Thunderstorms,
W79-04072 2B

SCALLOP
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

SCHEDULING
Basic Irrigation Scheduling Procedures,
W79-04171 3F

SCOUR
Experimental Studies of Beach Scour Due to Wave Action,
W79-04386 2L

SEDIMENT CONTROL
Study of Sediment Generation, Transport and Deposition in Semiarid Zones,
W79-04301 2J

Effectiveness of Sediment-Control Techniques used During Highway Construction in Central Pennsylvania,
W79-04403 4D

SEDIMENT DISCHARGE
Study of Sediment Generation, Transport and Deposition in Semiarid Zones,
W79-04301 2J

SEDIMENT DISTRIBUTION
Study of Sediment Generation, Transport and Deposition in Semiarid Zones,
W79-04301 2J

SEDIMENT GRAPH
Unit Sediment Graph,
W79-04172 2J

SEDIMENT LOAD
Study of Sediment Generation, Transport and Deposition in Semiarid Zones,
W79-04301 2J

SEDIMENT TRANSPORT
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

Flooding and Sediment Transport in a Small Alpine Drainage Basin in Colorado,
W79-04090 2J

Suspended Solids Carried by the Gallatin River of Southwestern Montana: II. Using Mineralogy for Inferring Sources,
W79-04099 2J

Hydrologic and Water Quality Modeling of Surface Water Discharges from Mining Operations,
W79-04134 6A

Study of Sediment Generation, Transport and Deposition in Semiarid Zones,
W79-04301 2J

Velocity Distribution and Sediment Motion Induced by Ship's Propeller in Ship Channels,
W79-04374 8B

SEDIMENT YIELD
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

A Large-Volume Interstitial Water Sediment Squeezer for Lake Sediments,
W79-04098 2J

Effectiveness of Sediment-Control Techniques used During Highway Construction in Central Pennsylvania,
W79-04403 4D

SEDIMENTATION
The Effects of Alum Sludge on Primary Sedimentation and Anaerobic Digestion,
W79-04001 5D

Reservoir Sedimentation as a Function of Precipitation Variability,
W79-04061 4D

SEDIMENTATION RATES
Sedimentation Rates in Lake Champlain Since Settlement by Man,
W79-04308 2J

SEDIMENTS
Trace Metal Relationships in Bottom Sediments of a Fresh Water Stream--The Buffalo River, Arkansas,
W79-04017 2J

SEEDLING EMERGENCE
A Technique for Assessing Seedling Emergence Under Drought Stress,
W79-04280 3F

SEEPAGE CONTROL
Asphalt-Crumb Rubber Waterproofing Membrane,
W79-04182 8G

SEISMIC DESIGN
Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

SELENIUM
Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

SEPARATION TECHNIQUES
Physico-Chemical Techniques for Treating Mill Effluents: A State-of-the-Art Review,
W79-04256 5D

SEPTIC TANKS
Septic System Liquid Level Control Apparatus,
W79-04481 5D

SEWAGE BACTERIA
Rapid Method for Determining Numbers of Sewage Pollution Bacteria (e.g., Coliforms) in Water,
W79-04389 5A

SEWAGE EFFLUENTS
Earthworm Populations, Soil Bulk Density, Porosity, and Water Stable Aggregates under Effluent Application,
W79-04005 5C

Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

Influence of Domestic Wastes on Energetic Pathways in Rocky Intertidal Communities,
W79-04133 5C

Responses of Several Forage and Field Crops to Subsurface Soil Warming and Sewage Effluent Spray Irrigation,
W79-04489 3F

The Effect of Combined Soil Warming and Irrigation on the Soil Surface Energy Budget,
W79-04490 2G

SEWAGE TREATMENT
The Effects of Alum Sludge on Primary Sedimentation and Anaerobic Digestion,
W79-04001 5D

Model Studies on the Effects of Alum Sludge on the Activated Sludge Waste Treatment Process,
W79-04114 5D

The Effects of Alum Sludge on Anaerobic Digestion,
W79-04115 5D

Effects of Alum Water Treatment Sludge on Domestic Wastewater Sludges,
W79-04116 5D

Citizens' Committee to Preserve Lake Logan v. Williams (State Agency's Maintenance of Water Quality Through Control of Effluents Found too Strict),
W79-04430 5D

Method for the Purification of Sewage Waters Which Contain Organic Compounds of an Anionic Nature,
W79-04463 5D

Organic Waste Drying Process,
W79-04464 5D

Sewage Treatment System,
W79-04473 5D

Septic System Liquid Level Control Apparatus,
W79-04481 5D

SHALES
Salt Pickup by Overland Flow in the Price River Basin, Utah,
W79-04298 2E

SHELLFISH POISON
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

SHORES
Macomb County Area of Particular Concern Inventory.
W79-04148 6G

SHREWSBURY RIVER (NJ)
Mixing in Shallow Coastal Sea: Case Study,
W79-04049 5B

SILT
Hydraulic Restoration of Stream Gravel for Spawning and Rearing of Salmon Species,
W79-04260 8I

SIMAZINE
Simazine Residues in Canal Water and Crops Resulting from Experimental Application for Ditchbank Weed Control,
W79-04267 5B

SIMULATED RAINFALL
A Rainfall Simulator for Field Studies of Runoff and Soil Erosion,
W79-04289 2B

SIMULATION
Application of a Version of the Stanford Model to a Small Piedmont Watershed,
W79-04086 2A

SIMULATION ANALYSIS
Computer Programs in Water Resources,
W79-04081 7C

A Rainfall Simulator for Field Studies of Runoff and Soil Erosion,
W79-04289 2B

SIMULATION MODELS
Computer Programs in Water Resources,
W79-04081 7C

SITES
Productive Land Use of Dredged Material Containment Areas,
W79-04385 5E

SIXMILE CREEK (CO)
Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

SKAGIT RIVER BASIN
Water in the Skagit River Basin, Washington,
W79-04028 7C

SLUDGE TREATMENT
The Filter Belt Press -- Application and Design,
W79-04286 5D

SMALL WATERSHEDS
Flood Frequency of Small Streams in Alabama,
W79-04024 6A

Flooding and Sediment Transport in a Small Alpine Drainage Basin in Colorado,
W79-04090 2J

SOCIAL ASPECTS
Social Aspects of Urban Water Conservation: A Review of the 1971-72 Field Study,
W79-04094 3D

SOCIAL IMPACT
Disintegration of a Traditional Resource-Use Complex: The Otomi of the Mezquital Valley, Hidalgo, Mexico,
W79-04293 6G

Resettlement and Desertification: The Wagogo of Dodoma District, Tanzania,
W79-04296 6A

Water Control and Desertification, the Resettled Nomads of Deh Luran, Iran,
W79-04306 6A

SOCIAL IMPACTS
Hill Reestablishment: Retrospective Community Study of a Relocated New England Town,
W79-04158 6B

SOIL ANALYSIS
Importance of the Organic Phosphorus Fraction in Extracts of Calcareous Soil,
W79-04213 2K

Sodium Bicarbonate Extraction to Estimate Nitrogen, Phosphorus, and Potassium Availability in Soils,
W79-04238 2G

SOIL CHEMICAL PROPERTIES
Greenhouse Evaluation of Residual Phosphate by Four Phosphorus Methods in Neutral and Calcareous Soils,
W79-04178 2K

A New Approach to Soil Testing: III. Differential Adsorption of Potassium,
W79-04227 2K

Sodium Bicarbonate Extraction to Estimate Nitrogen, Phosphorus, and Potassium Availability in Soils,
W79-04238 2G

SOIL CHEMISTRY
Surface Charge Manipulation of Constant Surface Potential Soil Colloids: I. Relation to Sorbed Phosphorus,
W79-04203 2K

Prediction of Phosphorus Diffusion from Fertilizer Source,
W79-04208 2K

SOIL CLASSIFICATION
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

SOIL CONTAMINATION
Atrazine Mobility in Two Soils Under Conventional Tillage,
W79-04212 2G

Effects of Evaporative Salt Water Cooling Towers on Salt Drift and Salt Deposition on Surrounding Soils,
W79-04220 5B

Extractability of 238Pu and 242Cm from a Contaminated Soil as a Function of pH and Certain Soil Components: HNO3-NaOH System,
W79-04236 2G

SOIL EROSION
To Solve Highway and Farm Water Management Problems,
W79-04190 4C

SOIL MOISTURE
Climate, Soil, and Vegetation--3. A Simplified Model of Soil Moisture Movement in the Liquid Phase,
W79-04039 2G

Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

SOIL PROFILES
Thermodynamics of Potassium-Calcium and Magnesium-Calcium Exchange Reactions on a Kaolinitic Soil Clay,
W79-04209 2K

Denitrification in Four California Soils: Effect of Soil Profile Characteristics,
W79-04234 2G

SOIL PROPERTIES
Earthworm Populations, Soil Bulk Density, Porosity, and Water Stable Aggregates under Effluent Application,
W79-04005 5C

Hydraulic and Electro-Osmotic Permeability Coefficients,
W79-04092 2F

SOIL SCIENCE
Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

SOIL TEMPERATURE
Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

Responses of Several Forage and Field Crops to Subsurface Soil Warming and Sewage Effluent Spray Irrigation,
W79-04489 3F

The Effect of Combined Soil Warming and Irrigation on the Soil Surface Energy Budget,
W79-04490 2G

SOIL TESTS
Development of a DTPA Soil Test for Zinc, Iron, Manganese, and Copper,
W79-04179 2K

A New Approach to Soil Testing: III. Differential Adsorption of Potassium,
W79-04227 2K

Colorimetric Determination of Urea in Soil Extracts Using an Automated System,
W79-04228 2K

SOIL TREATMENT
The Complexing and Adsorption of Cadmium in Soils in the Presence of EDTA and NTA,
W79-04007 5B

SOIL WATER
Climate, Soil, and Vegetation--7. A Derived Distribution of Annual Water Yield,
W79-04043 2A

Effect of Entrapped Soil Air on Infiltration,
W79-04124 2G

Water Uptake by Plants: I. Divided Root Experiments,
W79-04348 2I

Water Uptake by Plants: II. The Root Contact Model,
W79-04349 2I

SOIL-WATER INTERFACES
Transient Changes in the Soil-Water System from Irrigation with Saline Water: I. Theory,
W79-04202 2G

Transient Changes in the Soil-Water System from Irrigation with Saline Water: II. Analysis of Experimental Data,
W79-04205 2G

SOIL WATER MOVEMENT
Climate, Soil, and Vegetation--3. A Simplified Model of Soil Moisture Movement in the Liquid Phase,
W79-04039 2G

The Dependence of the Parameters in the Green and Ampt Infiltration Equation on the Initial Water Content in Draining and Wetting States,
W79-04155 2G

Transient Changes in the Soil-Water System from Irrigation with Saline Water: I. Theory,
W79-04202 2G

Transient Changes in the Soil-Water System from Irrigation with Saline Water: II. Analysis of Experimental Data,
W79-04205 2G

Multicomponent Cation Adsorption During Convective-Dispersive Flow Through Soils: Experimental Study,
W79-04218 2K

On Oscillation of Numerical Solution of a Modified Richards' Equation,
W79-04231 2G

SOIL-WATER-PLANT RELATIONSHIPS
Water Economy and Saline Water Use by Drip Irrigation,
W79-04303 3F

Value of Drip Irrigation Compared with Conventional Irrigation for Vegetable Production in a Hot Arid Climate,
W79-04304 3F

SOILS
The Complexing and Adsorption of Cadmium in Soils in the Presence of EDTA and NTA,
W79-04007 5B

SOLDIER CREEK BASIN
Hydrologic Data for Soldier Creek Basin, Kansas,
W79-04026 7C

SORGHUM
Economically Optimum Irrigation Patterns for Grain Sorghum Production: Texas High Plains,
W79-04495 3F

SOURIS-RED-RAINY RIVER BASINS
Water Resources Data for Minnesota, Water Year 1977--Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W79-04036 7C

SOUTH CAROLINA
State v. Beach Company (Sporadic, Recreation use of Private Beachfront Land not Sufficient to Create Public Easement to Beach).
W79-04429 2J

Which Way to the Beach. Public Access to Beaches for Recreational Use,
W79-04435 6E

SOUTH-CENTRAL FLORIDA
Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

SOUTH DAKOTA
Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

SOUTH PLATTE RIVER BASIN
South Platte River Basin Accomplishment Plan.
W79-04145 5G

SOUTH PLATTE RIVER BASIN (COLORADO)
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

SOUTH UMPQUA RIVER (OR)
Interim Report, South Umpqua River. Volume I: Main Report.
W79-04139 4D

Interim Report, South Umpqua River. Volume II, Appendix A: Economic Data and Analysis.
W79-04140 6C

Interim Report, South Umpqua River. Volume IV, Appendices E Through J, Reports of Coordinating Agencies.
W79-04141 6G

Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

SOUTHERN CENTRAL VALLEY BASINS
Water Resources Data for California, Water Year 1977--Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.
W79-04395 7C

SOUTHERN GREAT BASIN
Water Resources Data for California, Water Year 1977--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W79-04397 7C

SPATIAL DISTRIBUTION
Effects of Ambient Current and Density Stratification on Buoyant Jets,
W79-04387 5B

SPAWNING
Hydraulic Restoration of Stream Gravel for Spawning and Rearing of Salmon Species,
W79-04260 8I

SPAWNING BEDS
Hydraulic Restoration of Stream Gravel for Spawning and Rearing of Salmon Species,
W79-04260 8I

SPECKLED DACE
Wyoming's Speckled Dace,
W79-04408 5A

SPECTROPHOMETRY
Development of a DTPA Soil Test for Zinc, Iron, Manganese, and Copper,
W79-04179 2K

SPILLWAYS
Spillway Stilling Basin for Low Froude Flows.
W79-04355 8B

SPOON RIVER (IL)
An Assessment of Water Quality in the Spoon River, Part 2,
W79-04047 5A

An Assessment of Water Quality in the Spoon River, Part 1,
W79-04048 5A

SPRINKLER IRRIGATION
Nonuniform Sprinkler Irrigation Application Efficiency,
W79-04176 3F

Drip and/or Sprinkler,
W79-04192 3F

Development of Agricultural Irrigation in the Federal Republic of Germany,
W79-04194 3F

Drainage and the Center Pivot Sprinkler Method of Irrigation,
W79-04195 3F

Under-Tree Irrigation System.
W79-04199 3F

Rotary Spraying Device Particularly Useful for Water Irrigation,
W79-04466 3F

STABILITY
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

STANDARDS
Describing Irrigation Efficiency and Uniformity,
W79-04183 3F

Drip Systems Standards and Specifications.
W79-04200 3F

Standards for the Calculation of Irrigation Efficiencies,
W79-04201 3F

Data Needs in Urban Hydrology,
W79-04409 7A

STANFORD MODEL
Application of a Version of the Stanford Model to a Small Piedmont Watershed,
W79-04086 2A

STAPHYLOCOCCUS
Relationship Between Indicator Organisms and Selected Pathogenic Bacteria in Urban Waterways,
W79-04330 5A

STATISTICS
Climate, Soil, and Vegetation--1. Introduction to Water Balance Dynamics,
W79-04037 2A

STEAM
Transient Pressure Analysis in Geothermal Steam Reservoirs with an Immobile Vaporizing Liquid Phase--Summary Report,
W79-04410 1A

STORAGE ROUTING MODELS
A Storage-Routing Model Relating Drainage Basin Hydrology and Geomorphology,
W79-04222 2E

STORM RUNOFF
Estimating Peak Discharges in Small Urban Hawaiian Watersheds for Selected Rainfall Frequencies, Kane'ohe Watershed, O'Ahu, Hawaii,
W79-04126 2B

The Disastrous Flood of '78,
W79-04299 7B

Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

Non-Point Source Pollution Studies in the Chincoteague Bay System,
W79-04488 5B

STORM STRUCTURE
The Effects of Rain Gage Densities on the Analysis of Storm Total Rainfall from Convective Complexes,
W79-04108 2B

STORM WATER
Stormwater Analysis and Prediction in Houston,
W79-04052 5B

STORMS
Climate, Soil, and Vegetation--2. The Distribution of Annual Precipitation Derived from Observed Storm Sequences,
W79-04038 2B

The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

STRATIFIED FLOW
Salinity Distribution of a Highly Stratified Estuary,
W79-04364 2L

The Stability of a Two Layer Flow Without Shear in the Presence of Boundary Generated Turbulence: Field Verification,
W79-04372 8B

Modification of the Chezy Roughness Coefficient by Density Stratification,
W79-04373 8B

STREAMFLOW
Application of a Version of the Stanford Model to a Small Piedmont Watershed,
W79-04086 2A

Protecting Instream Flows Under Western Water Law: Selected Papers.
W79-04275 6E

Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

STREAMS
Assessing Nonpoint Water Quality for Small Streams,
W79-04051 5B

Protecting Instream Flows Under Western Water Law: Selected Papers.
W79-04275 6E

Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

Time of Travel of Solutes in Louisiana Streams,
W79-04401 5B

STRESS ANALYSIS
Design and Analysis of Auburn Dam, Volume Four Appendices: Dynamic Studies,
W79-04273 8A

STRIP CHARTS
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

STRIP MINES
Ground Water of the Fort Union Coal Region, Eastern Montana.
W79-04405 5B

STRUCTURAL DESIGN
Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

SUBMARINE SPRINGS
Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

SUBSURFACE FLOW
Finite Element Method for Subsurface Hydrology Using A Mixed Explicit-Implicit Scheme,
W79-04163 2F

SUBURBAN AREAS
Water Wells Help Texas City Save Money.
W79-04247 6B

SUNFISHES
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

SURFACE-GROUNDWATER RELATIONSHIPS
Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska,
W79-04391 2F

SURFACE IRRIGATION
On-Farm Level-Basin Irrigation--Save Water and Energy,
W79-04177 3F

A Kinematic Model for Surface Irrigation,
W79-04230 2G

SURFACE RUNOFF
Climate, Soil, and Vegetation--5. A Derived Distribution of Storm Surface Runoff,
W79-04041 2E

A Rainfall Simulator for Field Studies of Runoff and Soil Erosion,
W79-04289 2B

Pope V. City of Atlanta (Act Regulating Construction in River Flood Plain Held Not to Be Unconstitutional Taking of Property Without Compensation).
W79-04452 6E

SURFACE SEALING
Growth and Yield of Jojoba Plants in Native Stands Using Runoff-Collecting Microcatchments,
W79-04288 3F

SURFACE WATERS
Water Resources Data for Minnesota, Water Year 1977--Volume 2. Upper Mississippi and Missouri River Basins.
W79-04023 7C

Water in the Skagit River Basin, Washington,
W79-04028 7C

Water Resources Data for Alaska, Water Year 1977.
W79-04032 7C

Water Resources Data for Minnesota, Water Year 1977--Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W79-04036 7C

Groundwater-Surface Water Relationship Near Lake Michigan Shore,
W79-04371 2H

Water Resources Data for California, Water Year 1977--Volume 2. Pacific Slope Basins from Arroyo Grande to Oregon State Line Except Central Valley.
W79-04394 7C

Water Resources Data for California, Water Year 1977--Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.
W79-04395 7C

Water Resources Data for California, Water Year 1977--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W79-04397 7C

Water Resources Data for California, Water Year 1977--Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line.
W79-04398 7C

Freeland v. Dickson (Lower Landowner has no Right to Unimpeded Flow of Surface Water onto his Land),
W79-04434 2F

Recent Effluent Color Reduction Trials at Alberni Pulp and Paper,
W79-04499 5D

SURGES
Intake Screenwell Surging Caused by Wave Dynamics,
W79-04357 8A

SURVEYS
Report on Cibola Division (6) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04105 6B

Report on Imperial Division (7) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04106 6B

Report on Laguna Division (8) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04107 6B

Desertification of Arid Lands,
W79-04287 2A

Florida Board of Trustees of the Internal Improvement Trust Fund V. Wakulla Silver Springs Company.
W79-04451 6E

SUSPENDED SOLIDS
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

Suspended Solids Carried by the Gallatin River of Southwestern Montana: II. Using Mineralogy for Inferring Sources,
W79-04099 2J

A Study of the Fate of Suspended Solids from a Full-Scale Treatment Plant in Receiving Waters,
W79-04225 5B

Suspended Solids in Water.
W79-04258 2L

Apparatus and Process for Treating Contaminated Water,
W79-04477 5D

SWAMPS
Vegetative Communities of the Great Dismal Swamp: Identification and Mapping with Seasonal Color Infrared Photographs,
W79-04018 7B

TAILWATER
Tailwater Pits Gain Popularity in Texas,
W79-04170 3F

TAUTOGOLABRUS
The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

TCE
Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton,
W79-04318 5C

TECHNOLOGY
Technology and Desertification,
W79-04283 6A

TECTONIC INSTABILITY
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

TEMPERATURE
Upper Layer Observations and Simulation Using Kraus and Turner's Model in the Gulf of Finland,
W79-04045 2L

TEMPORAL DISTRIBUTION
Climate, Soil, and Vegetation--2. The Distribution of Annual Precipitation Derived from Observed Storm Sequences,
W79-04038 2B

TENSIOMETERS
Tensiometers Teach how to Save Fuel and Water,
W79-04165 3F

TERNS
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

TERTIARY TREATMENT
Tertiary Treatment of Effluents by Filtration,
W79-04279 5D

TESTING
A Note on Packer, Slug, and Recovery Tests in Unconfined Aquifers,
W79-04128 2F

TEXAS
External Costs of Land Subsidence in the Houston-Baytown Area,
W79-04015 2F

Stormwater Analysis and Prediction in Houston,
W79-04052 5B

Ammonia in Texas Streams During Low Flow from Municipal Wastewater,
W79-04063 5B

Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

TEXTILES
The Removal of Color from Effluent Using Various Adsorbents: Some Preliminary Economic Considerations,
W79-04253 5D

THAMES WATER AUTHORITY
Planning for Water Resources,
W79-04152 6D

THEORETICAL ANALYSIS
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

A Mathematical Model of Monthly Flow Sequences,
W79-04054 2E

Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

THERMAL POLLUTION
Transient Temperature Effects on BOD and DO Concentrations Along a Stream,
W79-04087 5G

THERMAL STORAGE
Ground-Heat-Assisted Heat Pumps,
W79-04243 8C

THERMAL WATER
Transient Pressure Analysis in Geothermal Steam Reservoirs with an Immobile Vaporizing Liquid Phase--Summary Report,
W79-04410 1A

THERMOCLINE
Upper Layer Observations and Simulation Using Kraus and Turner's Model in the Gulf of Finland,
W79-04045 2L

THERMODYNAMICS
Thermodynamics of Potassium-Calcium and Magnesium-Calcium Exchange Reactions on a Kaolinitic Soil Clay,
W79-04209 2K

THREE-DIMENSIONAL MODELING
Three-Dimensional Modeling of Groundwater Flow Systems,
W79-04149 2F

TIDAL EFFECTS
The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

TIDAL HYDRAULICS
Hydraulics in the Coastal Zone.
W79-04351 2L

TIDAL WATERS
Hydraulics in the Coastal Zone.
W79-04351 2L

Tidal Jet Flows Near Inlets,
W79-04361 2L

A Generalized Point-Velocity Method for Discharge Computations in Tidal Waterways,
W79-04378 2L

TIDES
Riverine Influence on Estuaries: A Case Study,
W79-04350 2L

TIME OF TRAVEL
Convective Contaminant Transport to Pumping Well,
W79-04022 5B

Time of Travel of Solutes in Louisiana Streams,
W79-04401 5B

TIME SERIES ANALYSIS
A Mathematical Model of Monthly Flow Sequences,
W79-04054 2E

TISSUE ANALYSIS
Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

In Vivo Effect of Endrin on Three Phosphatases in Kidney and Liver of the Fish Ophiocephalus Punctatus,
W79-04333 5C

Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5B

Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

Toxicities of Cadmium, Copper, and Zinc to Four Juvenile Stages of Chinook Salmon and Steelhead,
W79-04339 5C

Toxicity of Textile Waste to Some Teleost Fishes,
W79-04341 5C

Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

Alteration in the Activities of Three Peptidases and Lipase in the Digestive System of the Fish Channa Punctatus Exposed to Lead Nitrate,
W79-04345 5C

TOXICITY
Ammonia in Texas Streams During Low Flow from Municipal Wastewater,
W79-04063 5B

Salinity Effects on Growth and Toxin Content of Gonyaulax Excavata, A Marine Dinoflagellate Causing Paralytic Shellfish Poisoning,
W79-04313 5B

Toxicity of Cupric Ion to Eggs of the Spot Leiostomus Xanthurus and the Atlantic Silverside Menidia Menidia,
W79-04314 5C

Firth of Forth Oil Pollution Incident, February 1978,
W79-04316 5B

The Influence of Salinity on Toxicity of Cadmium and Chromium to the Blue Crab, Callinectes Sapidus,
W79-04319 5C

Acute Toxicity of the Water-Soluble Fraction of Cook Inlet Crude Oil to the Manila Clam,
W79-04323 5C

Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

Efficiency of Canal Biodegradation of Palm Oil Sludge and Its Pollution Effects,
W79-04332 5D

Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

Toxicities of Cadmium, Copper, and Zinc to Four Juvenile Stages of Chinook Salmon and Steelhead,
W79-04339 5C

Toxicity of Textile Waste to Some Teleost Fishes,
W79-04341 5C

The Acute Toxicity of Copper to Gammarus Fasciatus Say, A Freshwate Amphipod,
W79-04342 5C

The Effect of Temperature on Copper Tolerance of Paramecium,
W79-04343 5C

Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

Alteration in the Activities of Three Peptidases and Lipase in the Digestive System of the Fish Channa Punctatus Exposed to Lead Nitrate,
W79-04345 5C

TOXINS
Endotoxin in Waters of the State of Vermont,
W79-04492 5A

TRACE ELEMENTS
Trace Metal Relationships in Bottom Sediments of a Fresh Water Stream--The Buffalo River, Arkansas,
W79-04017 2J

Trace Elements in Runoff from Rainfall and Snowmelt at Several Localities in the Denver, Colorado, Metropolitan Area,
W79-04019 5B

TRACERS
Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

Time of Travel of Solutes in Louisiana Streams,
W79-04401 5B

TRADE ASSOCIATIONS
Water Systems Council: A Variety of Services to Pump Manufacturers and the Water Well Industry,
W79-04240 4B

TRANS-ALASKA PIPELINE SYSTEM (TAPS)
Channel Erosion Surveys Along the Taps Route, Alaska 1977,
W79-04411 2J

TRANSPORTATION
The Effects of Inland Navigation User Charges on Barge Transportation of Wheat,
W79-04075 6C

Major Port Improvement Alternatives,
W79-04376 8B

TREATIES
Balancing the Interests. The Third Un-Law of the Sea Conference - (7th Session),
W79-04441 6E

TREATMENT FACILITIES
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume I.
W79-04135 5D

What's New in Flotation. (Quoi de neuf en flottation),
W79-04224 5D

TRIBUTARIES TO LAKE SUPERIOR
Water Resources Data for Minnesota, Water Year 1977--Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W79-04036 7C

TROUT CREEK (COLORADO)
Environmental Effects of Western Coal Surface Mining, Part II: The Aquatic Macroinvertebrates of Trout Creek, Colorado,
W79-04252 5C

TRUCKEE RIVER
Water Resources Data for California, Water Year 1977--Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.
W79-04395 7C

TRUNK SEWERS
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

TURBIDITY
Turbidity Maxima in Partially Mixed Estuaries: A Two-Dimensional Numerical Model,
W79-04058 2L

TURBIDITY MAXIMA
Turbidity Maxima in Partially Mixed Estuaries: A Two-Dimensional Numerical Model,
W79-04058 2L

TURBULENT FLOW
Turbulent Transport to a Rotating Cylinder,
W79-04486 3A

UMPQUA RIVER (OR)
Interim Report, South Umpqua River. Volume I: Main Report.
W79-04139 4D

Interim Report, South Umpqua River. Volume II, Appendix A: Economic Data and Analysis.
W79-04140 6C

Interim Report, South Umpqua River. Volume IV, Appendices E Through J, Reports of Coordinating Agencies.
W79-04141 6G

Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

UNIT HYDROGRAPHS
Unit Sediment Graph,
W79-04172 2J

UNITED NATIONS
Conservation and the New Informal Composite Negotiating Text of the Law of the Sea Conference,
W79-04440 6E

Balancing the Interests. The Third Un-Law of the Sea Conference - (7th Session),
W79-04441 6E

UNITED STATES
Historical Profile of Quality of Water Laboratories and Activities, 1879--1973,
W79-04034 7B

UNSTEADY FLOW
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

UPPER CHATTAHOOCHEE RIVER BASIN
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

UPPER MISSISSIPPI RIVER BASIN
Water Resources Data for Minnesota, Water Year 1977--Volume 2. Upper Mississippi and Missouri River Basins.
W79-04023 7C

UPWELLING
Mean Upwelling Velocities on the Oregon Continental Shelf During Summer 1973,
W79-04059 2L

UPWELLING VELOCITIES
Mean Upwelling Velocities on the Oregon Continental Shelf During Summer 1973,
W79-04059 2L

URBAN DRAINAGE
Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part I,
W79-04109 4A

Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part II,
W79-04110 4A

URBAN HYDROLOGY
Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

Data Needs in Urban Hydrology,
W79-04409 7A

URBAN RUNOFF
Projecting Urban Runoff Flows and Loads,
W79-04050 5B

Dual Purpose Detention Basins and Surveillance Procedures in Urbanizing Watersheds,
W79-04077 4C

Relationship Between Indicator Organisms and Selected Pathogenic Bacteria in Urban Waterways,
W79-04330 5A

Data Needs in Urban Hydrology,
W79-04409 7A

URBANIZATION
Hydrologic Evaluation of Part of Central Volusia County, Florida,
W79-04030 4B

URBANIZING AREAS
Dual Purpose Detention Basins and Surveillance Procedures in Urbanizing Watersheds,
W79-04077 4C

UREA
Inhibition of Urease Activity by Heterocyclic Sulfur Compounds,
W79-04233 2K

UREAS
Colorimetric Determination of Urea in Soil Extracts Using an Automated System,
W79-04228 2K

US GEOLOGICAL SURVEY
Historical Profile of Quality of Water Laboratories and Activities, 1879--1973,
W79-04034 7B

USE RATES
The Effects of Inland Navigation User Charges on Barge Transportation of Wheat,
W79-04075 6C

USSR
A Winning Battle Against Destruction,
W79-04284 3F

UTAH
Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

VALVES
Float Valves Improve Pipeline Systems,
W79-04184 3F

VAPOR PRESSURE
Transient Pressure Analysis in Geothermal Steam Reservoirs with an Immobile Vaporizing Liquid Phase--Summary Report,
W79-04410 1A

VEGETATION
Vegetative Communities of the Great Dismal Swamp: Identification and Mapping with Seasonal Color Infrared Photographs,
W79-04018 7B

VIABILITY
Viability Measurements on Activated Sludge,
W79-04006 5D

VIRGINIA
Behavior and Transport of Mercury in River-Reservoir System Downstream of Inactive Chloralkali Plant,
W79-04290 5C

VITICULTURE
Land Tenure, Hazards, and the Economy: Viticulture in the Mendoza Oasis, Argentina,
W79-04291 3F

VOLUSIA COUNTY
Hydrologic Evaluation of Part of Central Volusia County, Florida,
W79-04030 4B

WALES
Planning for Water Resources,
W79-04152 6D

WALKER RIVER
Water Resources Data for California, Water Year 1977--Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.
W79-04395 7C

WASHINGTON
Water in the Skagit River Basin, Washington,
W79-04028 7C

Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies,
W79-04359 2L

WASHINGTON COUNTY (IL)
Wells and Ponds: Water Quality and Supply,
W79-04068 3C

WASTE DISPOSAL
Waste Surveillance in Subsurface Disposal Projects,
W79-04097 5E

WASTE STORAGE
Wastewater Treatment for Small Rural Communities,
W79-04119 5D

WASTE TREATMENT
Effects of Alum Water Treatment Sludge on Domestic Wastewater Sludges,
W79-04116 5D

WASTE TREATMENT INDUSTRIAL WASTES
Efficiency of Canal Biodegradation of Palm Oil Sludge and Its Pollution Effects,
W79-04332 5D

WASTE WATER DISPOSAL
Cessation of Return Flow as a Means of Complying with Pollution Control Laws,
W79-04445 6E

WASTE WATER (POLLUTION)
Ammonia in Texas Streams During Low Flow from Municipal Wastewater,
W79-04063 5B

Upper Trinity River Basin Comprehensive Sewerage Plan, Volume I.
W79-04135 5D

WASTE WATER TREATMENT
A Basis for Aeration Design,
W79-04002 5D

Experimental Evaluation of Chemical Transport in Water-Saturated Porous Media: 2. Sorbing Media,
W79-04014 5A

Model Studies on the Effects of Alum Sludge on the Activated Sludge Waste Treatment Process,
W79-04114 5D

Wastewater Treatment for Small Rural Communities,
W79-04119 5D

Upper Trinity River Basin Comprehensive Sewerage Plan, Volume I.
W79-04135 5D

Escanaba's Environmental Systems: The First Five Years,
W79-04219 5D

Limiting the Costs of Pollution Control: Treatment of Effluents at the Source (Limitation du cout de la depollution: traitement des effluents a la source),
W79-04221 5D

What's New in Flotation. (Quoi de neuf en flottation),
W79-04224 5D

The Removal of Color from Effluent Using Various Adsorbents: Some Preliminary Economic Considerations,
W79-04253 5D

Toxicity Removed by Foam Separation,
W79-04254 5D

Tertiary Treatment of Effluents by Filtration,
W79-04279 5D

Enso-Biox Method for Deodorization and Detoxification of Waste Waters,
W79-04295 5D

Experience with the Operation of an Effluent Clarifier (Experience d'operation d'un clarificateur d'effluents),
W79-04305 5D

The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

Analysis of Practicability of a Solution to the Problem of Pollution by Spent Liquors (Analyse de practicabilite d'une solution au probleme de la pollution par les liqueurs residuelles),
W79-04400 5D

Method for the Purification of Sewage Waters Which Contain Organic Compounds of an Anionic Nature,
W79-04463 5D

Organic Waste Drying Process,
W79-04464 5D

Water Purification with Fragmented Oil Shale,
W79-04465 5D

Process for Treating Sewage, Particularly on Ships,
W79-04470 5D

Method of Resolving a Mixture of Oil, Water, and Solids,
W79-04471 5D

Sewage Treatment System,
W79-04473 5D

Settling Tank,
W79-04474 5D

Method and Apparatus for Treating Metal Containing Waste Water,
W79-04478 5D

Simultaneous Treatment of SO2 Containing Stack Gases and Waste Water,
W79-04480 5D

Septic System Liquid Level Control Apparatus,
W79-04481 5D

WASTEWATER TREATMENT
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

WASTEWATER TREATMENT PLANTS
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

WATER ALLOCATION
Conjunctive Ground and Surface Water Allocations: The Economics of a Quasi-Market Solution,
W79-04078 6B

Federal Reserved Rights and the Interstate Allocation of Water,
W79-04346 6E

Marketing of Surplus Water from Federal Reservoirs,
W79-04347 6E

WATER ALLOCATION (POLICY)
Water Allocation: Constraints and Opportunities,
W79-04442 6E

WATER ANALYSIS
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

WATER BALANCE
Climate, Soil, and Vegetation--1. Introduction to Water Balance Dynamics,
W79-04037 2A

Climate, Soil, and Vegetation--6. Dynamics of the Annual Water Balance,
W79-04042 2A

Climate, Soil, and Vegetation--7. A Derived Distribution of Annual Water Yield,
W79-04043 2A

WATER BIRDS
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

WATER CHEMISTRY
Ground Water of the Island of Montreal, Canada,
W79-04060 2F

Behavior of a Micro Flowthrough Copper Ion-Selective Electrode System in the Millimolar to Submicromolar Concentration Range,
W79-04102 1A

A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

WATER CIRCULATION
A Three-Dimensional Numerical Model of Estuarine Circulation,
W79-04354 2L

WATER CONSERVATION
Social Aspects of Urban Water Conservation: A Review of the 1971-72 Field Study,
W79-04094 3D

Agriculture and Conservation--Ecological and Social Aspects,
W79-04164 3F

Computer Scheduling Can Save More Water,
W79-04198 3F

Washing of Unbleached Kraft Pulp with Effluents (Promyvka sul'fatnoi nebelenoi tsellyulozy stochnymi vodami),
W79-04423 3E

WATER CONVEYANCE
The CAP - An Engineering Marvel,
W79-04294 8A

WATER DEMAND
A Cross-Sectional Investigation of the Determinants of Urban Residential Water Demand in the United States, 1960 and 1970,
W79-04003 6D

To Establish a National Water Policy.
W79-04447 6E

WATER HARVESTING
Growth and Yield of Jojoba Plants in Native Stands Using Runoff-Collecting Microcatchments,
W79-04288 3F

WATER LAW
The Canada Water Act Annual Report, 1977-1978.
W79-04154 6E

WATER LEVEL FLUCTUATIONS
Water Resources of Camas Prairie, South-Central Idaho,
W79-04031 2F

WATER LEVELS
Limnological Characteristics of Cypress Lake, Upper Kissimmee River Basin, Florida,
W79-04025 2H

Determination of Aquifer Diffusivity from Annual Fluctuations of Ground Water Levels,
W79-04069 2F

A Finite Element Aquifer Model Which Takes Into Account Elevation Changes of the Aquifer,
W79-04083 2F

An Acoustic Probe for Precise Determination of Deep Water Levels in Boreholes,
W79-04241 7B

Water Levels in Artesian and Nonartesian Aquifers of Florida, 1975-76,
W79-04404 2F

Index to Water-Resources Data for Louisiana, Ground-Water Records,
W79-04412 7C

WATER LOSS
Huelsmann V. State (Recovery Denied for Loss of Well Water Caused by Highway Construction).
W79-04456 2F

WATER MANAGEMENT (ADMINISTRATIVE)
Planning for Water Resources,
W79-04152 6D

WATER MANAGEMENT (APPLIED)
Energy and Water Resources.
W79-04112 6D

Planning for Proper Use of Land and Water.
W79-04113 6A

To Establish a National Water Policy.
W79-04447 6E

WATER MOVEMENT
Irrigation Water Movement Below the Corn Root Zone in Crete Silt Loam,
W79-04483 2G

WATER POLICY
Planning for Water Resources,
W79-04152 6D

To Establish a National Water Policy.
W79-04447 6E

WATER POLLUTION
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

Distribution of Autotrophic Nitrifying Bacteria in a Polluted River (The Passaic),
W79-04070 5B

Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

South Platte River Basin Accomplishment Plan.
W79-04145 5G

Behavior and Transport of Mercury in River-Reservoir System Downstream of Inactive Chloralkali Plant,
W79-04290 5C

WATER POLLUTION ABATEMENT
South Platte River Basin Accomplishment Plan.
W79-04145 5G

WATER POLLUTION CONTROL
Cladoceran Survival Studies in a Kraft Pulp Mill Aerated Stabilization Basin,
W79-04111 5D

Progress of Protection of the Environment and Resources in the United States-A Historical Survey,
W79-04278 6E

E. I. Dupont De Nemours & Co. v. Train - EPA Authority to set Industry Wide Effluent Limitations by Regulation,
W79-04439 6E

Cessation of Return Flow as a Means of Complying with Pollution Control Laws,
W79-04445 6E

WATER POLLUTION EFFECT
Marine Receiving Water Monitoring Program for Pulp Mill Effluent (Of Canadian Cellulose Co. Ltd.) at Prince Rupert,
W79-04416 5A

WATER POLLUTION SOURCES
The Effects of Alum Sludge on Primary Sedimentation and Anaerobic Digestion,
W79-04001 5D

Bacterial Metabolism of Arylsulfonates: Role of Meta Cleavage in Benzene Sulfonate Oxidation by Pseudomonas Testosteroni,
W79-04013 5D

Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

Stormwater Analysis and Prediction in Houston,
W79-04052 5B

The Effects of Alum Sludge on Anaerobic Digestion,
W79-04115 5D

A Rational Approach for Optimizing Application Rates of Fertilizer Nitrogen to Reduce Potential Nitrate Pollution of Natural Waters,
W79-04162 5B

Salt Pickup by Overland Flow in the Price River Basin, Utah,
W79-04298 2E

Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska,
W79-04391 2F

Nonpoint Source Pollution,
W79-04443 5A

WATER POLLUTION TREATMENT
Oil-Water Separator,
W79-04461 5G

Water Purification with Fragmented Oil Shale,
W79-04465 5D

Process for Treating Sewage, Particularly on Ships,
W79-04470 5D

Method of Resolving a Mixture of Oil, Water, and Solids,
W79-04471 5D

Sewage Treatment System,
W79-04473 5D

Settling Tank,
W79-04474 5D

Apparatus and Process for Treating Contaminated Water,
W79-04477 5D

Method and Apparatus for Treating Metal Containing Waste Water,
W79-04478 5D

Method of Removing Oil from Water,
W79-04479 5D

Simultaneous Treatment of SO2 Containing Stack Gases and Waste Water,
W79-04480 5D

WATER PROPERTIES
A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

Water: A Comprehensive Treatise. (Vol. 5). Water in Disperse Systems.
W79-04257 1B

WATER PURIFICATION
EPA Proposed Far-Reaching Regulations for Reducing Synthetic Organics in Drinking Water.
W79-04422 5F

Water Purifying System and Pump Therefor,
W79-04460 5F

Power Generation and Potable Water Recovery from Salinous Water,
W79-04468 3A

Electrolytic Cell for Treatment of Water,
W79-04469 5F

WATER QUALITY
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

Trace Elements in Runoff from Rainfall and Snowmelt at Several Localities in the Denver, Colorado, Metropolitan Area,
W79-04019 5B

Water Resources Data for Minnesota, Water Year 1977--Volume 2. Upper Mississippi and Missouri River Basins.
W79-04023 7C

Limnological Characteristics of Cypress Lake, Upper Kissimmee River Basin, Florida,
W79-04025 2H

Water Resources of Camas Prairie, South-Central Idaho,
W79-04031 2F

Water Resources Data for Alaska, Water Year 1977.
W79-04032 7C

Historical Profile of Quality of Water Laboratories and Activities, 1879--1973,
W79-04034 7B

Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

Water Resources Data for Minnesota, Water Year 1977--Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W79-04036 7C

An Assessment of Water Quality in the Spoon River, Part 2,
W79-04047 5A

An Assessment of Water Quality in the Spoon River, Part 1,
W79-04048 5A

Projecting Urban Runoff Flows and Loads,
W79-04050 5B

Assessing Nonpoint Water Quality for Small Streams,
W79-04051 5B

Stormwater Analysis and Prediction in Houston,
W79-04052 5B

Wells and Ponds: Water Quality and Supply,
W79-04068 3C

Interim Report, South Umpqua River. Volume II, Appendix A: Economic Data and Analysis.
W79-04140 6C

South Platte River Basin Accomplishment Plan.
W79-04145 5G

The Canada Water Act Annual Report, 1977-1978.
W79-04154 6E

You Never Miss the Water ... Till the Well Runs Dry,
W79-04244 6D

Prototype Reaeration Measurements, Beltzville Dam, Pennsylvania,
W79-04380 5G

Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska,
W79-04391 2F

Potential Potable-Water Supplies in Redwood National Park,
W79-04393 6D

Water Resources Data for California, Water Year 1977--Volume 2. Pacific Slope Basins from Arroyo Grande to Oregon State Line Except Central Valley.
W79-04394 7C

Water Resources Data for California, Water Year 1977--Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.
W79-04395 7C

Water Resources Data for California, Water Year 1977--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W79-04397 7C

Water Resources Data for California, Water Year 1977--Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line.
W79-04398 7C

Ground Water of the Fort Union Coal Region, Eastern Montana.
W79-04405 5B

Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

Wyoming's Speckled Dace,
W79-04408 5A

Data Needs in Urban Hydrology,
W79-04409 7A

Index to Water-Resources Data for Louisiana, Ground-Water Records,
W79-04412 7C

Section 404 of the Federal Water Pollution Control Act Amendments of 1977: Hydrologic Modification, Wetlands Protection and the Physical Integrity of the Nation's Waters,
W79-04419 5A

Wisconsin's Environmental Decade, Inc. v. Department of Natural Resources (City Policy Could not Prevent Chemical Treatment of State Waters),
W79-04428 2H

Federal Water Pollution Control Act Amendments of 1977 (Seattle, Wash.).
W79-04457 6E

WATER QUALITY ACT
Progress of Protection of the Environment and Resources in the United States-A Historical Survey,
W79-04278 6E

WATER QUALITY CONTROL
Accomplishment Plan, Region VIII. Comprehensive Energy-Environment Program.
W79-04137 6E

Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

The Canada Water Act Annual Report, 1977-1978.
W79-04154 6E

Protecting Instream Flows Under Western Water Law: Selected Papers.
W79-04275 6E

Nonpoint Source Pollution,
W79-04443 5A

Water Purifying System and Pump Therefor,
W79-04460 5F

Electrolytic Cell for Treatment of Water,
W79-04469 5F

Method of Removing Oil from Water,
W79-04479 5D

WATER QUALITY DATA
South Platte River Basin Accomplishment Plan.
W79-04145 5G

WATER QUALITY INDICATOR
Wyoming's Speckled Dace,
W79-04408 5A

WATER QUALITY MANAGEMENT (ADMINISTRATIVE)
The Canada Water Act Annual Report, 1977-1978.
W79-04154 6E

WATER QUALITY STANDARDS
South Platte River Basin Accomplishment Plan.
W79-04145 5G

A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

A Case for Reappraisal of Indian Water Pollution Standards as Applicable to Pulp and Paper Industry,
W79-04255 6E

EPA Proposed Far-Reaching Regulations for Reducing Synthetic Organics in Drinking Water.
W79-04422 5F

Citizens' Committee to Preserve Lake Logan v. Williams (State Agency's Maintenance of Water Quality Through Control of Effluents Found too Strict),
W79-04430 5D

Federal Water Pollution Control Act Discharge Permit System - An Industrial Viewpoint,
W79-04454 6E

WATER RESOURCE DEVELOPMENT
Planning for Proper Use of Land and Water.
W79-04113 6A

WATER RESOURCE MANAGEMENT
Hill Reestablishment: Retrospective Community Study of a Relocated New England Town,
W79-04158 6B

WATER RESOURCES
Water in the Skagit River Basin, Washington,
W79-04028 7C

Energy and Water Resources.
W79-04112 6D

Twelfth Annual Report, Program Activities, July 1, 1975-June 30, 1976.
W79-04117 10F

Macomb County Area of Particular Concern Inventory.
W79-04148 6G

Planning for Water Resources,
W79-04152 6D

WATER RESOURCES DEVELOPMENT
Interim Report, South Umpqua River. Volume I: Main Report.
W79-04139 4D

Interim Report, South Umpqua River. Volume II, Appendix A: Economic Data and Analysis.
W79-04140 6C

Interim Report, South Umpqua River. Volume IV, Appendices E Through J, Reports of Coordinating Agencies.
W79-04141 6G

Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

Big Muddy River Comprehensive Basin Study, Illinois, Vol. 7, Appendix M and N.
W79-04144 6D

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. VI: Appendix P - Plan Formulation.
W79-04147 6G

Planning for Water Resources,
W79-04152 6D

Water Wells Help Texas City Save Money.
W79-04247 6B

WATER RESOURCES DIVISION LABORATORIES
Historical Profile of Quality of Water Laboratories and Activities, 1879--1973,
W79-04034 7B

WATER RESOURCES MANAGEMENT
The Canada Water Act Annual Report, 1977-1978.
W79-04154 6E

Precipitation Management and the Environment, an Overview of the Skywater IX Conference.
W79-04157 2B

WATER RESOURCES PLANNING
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. 1, Main Report.
W79-04146 6G

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. VI: Appendix P - Plan Formulation.
W79-04147 6G

The Canada Water Act Annual Report, 1977-1978.
W79-04154 6E

Testing Social Indicators in the Techcom Model for Water Development,
W79-04491 6A

WATER RESOURCES PLANNING ACT
208 Water Quality Planning How it Will Affect You,
W79-04193 6E

WATER REUSE
Washing of Unbleached Kraft Pulp with Effluents (Promyvka sul'fatnoi nebelenoi tsellyulozy stochnymi vodami),
W79-04423 3E

WATER RIGHTS
Federal Reserved Rights and the Interstate Allocation of Water,
W79-04346 6E

WATER SAMPLING
Water Sampling Bucket,
W79-04459 7B

WATER SHORTAGE
Social Aspects of Urban Water Conservation: A Review of the 1971-72 Field Study,
W79-04094 3D

You Never Miss the Water ... Till the Well Runs Dry,
W79-04244 6D

Water Systems and Their Emergencies,
W79-04497 6B

WATER SPREADING
Artificial Recharge: Part II,
W79-04239 4B

WATER STORAGE
Water System Design for a Low Yield Well,
W79-04250 8A

WATER SUPPLY
Hydrologic Evaluation of Part of Central Volusia County, Florida,
W79-04030 4B

Wells and Ponds: Water Quality and Supply,
W79-04068 3C

Upper Trinity River Basin Comprehensive Sewerage Plan, Volume I.
W79-04135 5D

Water System Design for a Low Yield Well,
W79-04250 8A

Institutional Aspects of Water Resources Management at Substate Level,
W79-04309 6E

Potential Potable-Water Supplies in Redwood National Park,
W79-04393 6D

Water Systems and Their Emergencies,
W79-04497 6B

WATER SUPPLY DEVELOPMENT
Economic Analysis of the Conjunctive Use of Surface Water and Ground Water of Differing Prices and Qualities: A Coming Problem for Arizona Agriculture,
W79-04104 6B

WATER SYSTEMS
Water Systems Council: A Variety of Services to Pump Manufacturers and the Water Well Industry,
W79-04240 4B

WATER TABLE
Convective Contaminant Transport to Pumping Well,
W79-04022 5B

Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

WATER TABLE

Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

WATER TEMPERATURE
Upper Layer Observations and Simulation Using Kraus and Turner's Model in the Gulf of Finland,
W79-04045 2L

Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

The Effect of Temperature on Copper Tolerance of Paramecium,
W79-04343 5C

Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

WATER TRANSFER
Economic Analysis of the Conjunctive Use of Surface Water and Ground Water of Differing Prices and Qualities: A Coming Problem for Arizona Agriculture,
W79-04104 6B

WATER TREATMENT
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

Update: What's in the Water.
W79-04242 5F

EPA Proposed Far-Reaching Regulations for Reducing Synthetic Organics in Drinking Water.
W79-04422 5F

Federal Water Pollution Control Act Amendments of 1977 (Seattle, Wash.).
W79-04457 6E

Water Purifying System and Pump Therefor,
W79-04460 5F

Electrolytic Cell for Treatment of Water,
W79-04469 5F

WATER UTILIZATION
Appropriation for Instream Flow Maintenance: A Progress Report on 'New' Public Western Water Rights,
W79-04438 6E

WATER WELLS
Wells and Ponds: Water Quality and Supply,
W79-04068 3C

Water Wells Help Texas City Save Money.
W79-04247 6B

Index to Water-Resources Data for Louisiana, Ground-Water Records,
W79-04412 7C

WATER YIELD
Climate, Soil, and Vegetation--7. A Derived Distribution of Annual Water Yield,
W79-04043 2A

Water System Design for a Low Yield Well,
W79-04250 8A

WATERFOWL
Firth of Forth Oil Pollution Incident, February 1978,
W79-04316 5B

WATERSHED MANAGEMENT
Interim Report, South Umpqua River. Volume I: Main Report.
W79-04139 4D

Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

Big Muddy River Comprehensive Basin Study, Illinois, Summary Report.
W79-04143 6D

Big Muddy River Comprehensive Basin Study, Illinois, Vol. 7, Appendix M and N.
W79-04144 6D

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. VI: Appendix P - Plan Formulation.
W79-04147 6G

Small Mammal Habitat in Different-Aged Chamise-Wedgeleaf Ceanothus Chaparral,
W79-04259 4A

WATERSHEDS
Hydrologic Parameters from LANDSAT Imagery for Williams Fork Watershed,
W79-04073 5A

Big Muddy River Comprehensive Basin Study, Illinois, Summary Report.
W79-04143 6D

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. 1, Main Report.
W79-04146 6G

Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

WATERSHEDS (BASINS)
Hydrologic Data for Soldier Creek Basin, Kansas,
W79-04026 7C

A Unified Approach to Watershed Modelling,
W79-04084 2A

Unit Sediment Graph,
W79-04172 2J

A Storage-Routing Model Relating Drainage Basin Hydrology and Geomorphology,
W79-04222 2E

Effectiveness of Sediment-Control Techniques used During Highway Construction in Central Pennsylvania,
W79-04403 4D

WAVE (WATER)
Improved Drag Force Linearizations for Structural Dynamic Calculations,
W79-04358 8B

WAVES
Dynamics of Wave-Induced Currents in Sediments,
W79-04076 2J

WAVES (WATER)
Intake Screenwell Surging Caused by Wave Dynamics,
W79-04357 8A

Wave Runup on Irregular Beach Profiles,
W79-04362 2L

Minimizing Wave Transmission Through Jettied Inlets,
W79-04363 2H

Diffraction of Waves by A Shore-Connected Breakwater,
W79-04377 8B

WEATHER MODIFICATION
Precipitation Management and the Environment, an Overview of the Skywater IX Conference.
W79-04157 2B

WELL DEVELOPMENT
Blasting-It Turns Dry Holes into Wet Ones,
W79-04251 8A

WELL PRODUCTION
Drain-Hole Drilling Can Increase Productivity,
W79-04249 8A

WELLS
A Note on Packer, Slug, and Recovery Tests in Unconfined Aquifers,
W79-04128 2F

Huelsmann V. State (Recovery Denied for Loss of Well Water Caused by Highway Construction).
W79-04456 2F

WEST INDIES
Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

WESTERN CANADA
The Canada Water Act Annual Report, 1977-1978.
W79-04154 6E

WETLANDS
American Dredging Company v. State Department of Environmental Protection (Order Banning Dumping of Dredge Soil in Protected Wetlands Area Upheld),
W79-04415 5G

Section 404 of the Federal Water Pollution Control Act Amendments of 1977: Hydrologic Modification, Wetlands Protection and the Physical Integrity of the Nation's Waters,
W79-04419 5A

Biomass and Primary Production in Freshwater Tidal Wetlands of the Middle Atlantic Coast,
W79-04485 2I

WHEATGRASSES
A Technique for Assessing Seedling Emergence Under Drought Stress,
W79-04280 3F

WHITE RIVER BASIN (AR AND MO)
Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. 1, Main Report.
W79-04146 6G

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. VI: Appendix P - Plan Formulation.
W79-04147 6G

WILDLIFE MANAGEMENT
Water Allocation: Constraints and Opportunities,
W79-04442 6E

WISCONSIN
Wisconsin's Environmental Decade, Inc. v. Department of Natural Resources (City Policy Could not Prevent Chemical Treatment of State Waters),
W79-04428 2H

WITHDRAWAL
Hydrologic Evaluation of Part of Central Volusia County, Florida,
W79-04030 4B

WITHDRAWL
Selective Withdrawal from Two-Layer Fluid,
W79-04123 8B

WYOMING
Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix.
W79-04138 6E

Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

Wyoming's Speckled Dace,
W79-04408 5A

YELLOWSTONE RIVER (MONTANA)
Aquatic Environmental Analysis in the Lower Yellow-Stone River,
W79-04276 6G

ZINC
Toxicities of Cadmium, Copper, and Zinc to Four Juvenile Stages of Chinook Salmon and Steelhead,
W79-04339 5C

Acutely Lethal Levels of Cadmium, Copper, and Zinc to Adult Male Coho Salmon and Steelhead,
W79-04340 5C

ZONING
Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

ZOOPLANKTON
Cladoceran Survival Studies in a Kraft Pulp Mill Aerated Stabilization Basin,
W79-04111 5D

AUTHOR INDEX

AALTO, J.
A Finite Element Aquifer Model Which Takes Into Account Elevation Changes of the Aquifer,
W79-04083 2F

ABBOTT, H. E. JR.
Social Aspects of Urban Water Conservation: A Review of the 1971-72 Field Study,
W79-04094 3D

ABBOTT, J. L.
Importance of the Organic Phosphorus Fraction in Extracts of Calcareous Soil,
W79-04213 2K

ADACHI, R.
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

ADLER, S. P.
Hill Reestablishment: Retrospective Community Study of a Relocated New England Town,
W79-04158 6B

AFOUNDA, A. A.
A Unified Approach to Watershed Modelling,
W79-04084 2A

AGGELIDES, S.
The Dependence of the Parameters in the Green and Ampt Infiltration Equation on the Initial Water Content in Draining and Wetting States,
W79-04155 2G

AHLERT, R. C.
Mixing in Shallow Coastal Sea: Case Study,
W79-04049 5B

AKERS, J. P.
Potential Potable-Water Supplies in Redwood National Park,
W79-04393 6D

AKIRI, B.
Sodium Bicarbonate Extraction to Estimate Nitrogen, Phosphorus, and Potassium Availability in Soils,
W79-04238 2G

AL-LAYLA, M. A.
Effect of Salinity on Agriculture in Iraq,
W79-04173 3F

ALDRIDGE, B. N.
Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

ALLEN, J. F.
Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

ALLEY, W. M.
Trace Elements in Runoff from Rainfall and Snowmelt at Several Localities in the Denver, Colorado, Metropolitan Area,
W79-04019 5B

ALVI, A. A.
Drainage and the Center Pivot Sprinkler Method of Irrigation,
W79-04195 3F

AMBO, K.
Determination of Aquifer Diffusivity from Annual Fluctuations of Ground Water Levels,
W79-04069 2F

ANAYA-GARDUNO, M.
Technology and Desertification,
W79-04283 6A

ANDERSON, L. W. J.
Simazine Residues in Canal Water and Crops Resulting from Experimental Application for Ditchbank Weed Control,
W79-04267 5B

ANDERSON, M. W.
A Set of Coordinated Mathematical Models for the Coastal Zone,
W79-04353 2L

ANDREWS, W. H.
Testing Social Indicators in the Techcom Model for Water Development,
W79-04491 6A

ANGUS, J. S.
Evaluation of a Barrier Against Seawater Intrusion,
W79-04370 2L

ARAD, A.
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

ARAI, M.
Design and Analysis of Auburn Dam, Volume Five: Summary and Conclusions,
W79-04274 8A

Design and Analysis of Auburn Dam, Volume Four Appendices: Dynamic Studies,
W79-04273 8A

Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

Design and Analysis of Auburn Dam, Volume Four Supplement: Dynamic Studies,
W79-04272 8A

Design and Analysis of Auburn Dam, Volume One: Design Data,
W79-04268 8A

Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Two: Foundation Studies,
W79-04269 8A

ARLINE, T.
The Legal Significance of the Local Government Comprehensive Plan,
W79-04420 6E

ARNER, D. H.
The Economic Impact of Increased Forest and Farmland Beaver Damage in Mississippi,
W79-04074 2H

AROESTY, J.
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

ARTHUR, R. M.
Let's Upgrade the BOD Test,
W79-04277 5A

ASAY, K. H.
A Technique for Assessing Seedling Emergence Under Drought Stress,
W79-04280 3F

ATKINSON, P. G.
Transient Pressure Analysis in Geothermal Steam Reservoirs with an Immobile Vaporizing Liquid Phase--Summary Report,
W79-04410 1A

AUSTIN, E. P.
The Filter Belt Press -- Application and Design,
W79-04286 5D

BABAEV, A. G.
A Winning Battle Against Destruction,
W79-04284 3F

BAKER, D. E.
A New Approach to Soil Testing: III. Differential Adsorption of Potassium,
W79-04227 2K

BALIGAR, V. C.
Potassium and Rubidium Adsorption and Diffusion in Soil,
W79-04216 2K

Use of K/Rb Ratio to Characterize Potassium Uptake by Plant Roots Growing in Soil,
W79-04206 2I

BALLAUX, J. C.
Retention and Leaching of Nutrients in a Limed Ultisol Under Cropping,
W79-04500 5B

BANKS, J. E.
Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

BAR-YOSEF, B.
Phosphate Desorption from Kaolinite Suspensions,
W79-04207 2K

Sodium Bicarbonate Extraction to Estimate Nitrogen, Phosphorus, and Potassium Availability in Soils,
W79-04238 2G

BARBER, S. A.
Potassium and Rubidium Adsorption and Diffusion in Soil,
W79-04216 2K

Use of K/Rb Ratio to Characterize Potassium Uptake by Plant Roots Growing in Soil,
W79-04206 2I

BARNETT, S. M.
Microbial Growth on Hydrocarbons -- Some Experimental Results,
W79-04101 5A

BARRETT, B. B.
A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

BARRETT, J. W. H.
Effect of Irrigation Regime on Maize Yields,
W79-04174 3F

BASCO, D. R.
On Numerical Accuracy in Computational Hydraulics,
W79-04369 8B

BEATTIE, B. R.
A Cross-Sectional Investigation of the Determinants of Urban Residential Water Demand in the United States, 1960 and 1970,
W79-04003 6D

BEAUCHAMP, J. J.
Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

BEDIENT, P. G.
Stormwater Analysis and Prediction in Houston,
W79-04052 5B

BENEDICT, B. A.
Diffusion of Dredged Material in the Mississippi River,
W79-04384 5B

Modeling Dissolved Oxygen in the Near-Field,
W79-04366 5B

BENVILLE, P. E. JR.
Acute Toxicity of the Water-Soluble Fraction of Cook Inlet Crude Oil to the Manila Clam,
W79-04323 5C

BERGER, R. G.
Cessation of Return Flow as a Means of Complying with Pollution Control Laws,
W79-04445 6E

BERRIMAN, J. W.
Major Port Improvement Alternatives,
W79-04376 8B

BERRY, M. P.
Action Programs for Water Yield Improvement on Arizona's Watersheds: Political Constraints to Implementation,
W79-04093 6E

BESSE, R.
What's New in Flotation. (Quoi de neuf en flottation),
W79-04224 5D

BIGGS, D. C.
Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton,
W79-04318 5C

BINGHAM, R. H.
Flood Frequency of Small Streams in Alabama,
W79-04024 6A

BINKLEY, J. K.
The Effects of Inland Navigation User Charges on Barge Transportation of Wheat,
W79-04075 6C

BIRTLES, A. B.
Identification and Separation of Major Base Flow Components from a Stream Hydrograph,
W79-04067 2E

BISWAS, C. R.
A Rational Approach for Optimizing Application Rates of Fertilizer Nitrogen to Reduce Potential Nitrate Pollution of Natural Waters,
W79-04162 5B

BLACK, R. D.
Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies,
W79-04359 2L

BLADEL, W. J.
Behavior of a Micro Flowthrough Copper Ion-Selective Electrode System in the Millimolar to Submicromolar Concentration Range,
W79-04102 1A

BLAEDEL, W. J.
Application of Ion Exchange Membranes to Sampling and Enrichment: Interference of Metal Ion Binding Groups,
W79-04103 1A

BLAIR, J.
Better Water Use, Say Texans,
W79-04191 3F

Tailwater Pits Gain Popularity in Texas,
W79-04170 3F

BLAKE, M. J.
Floating Nuclear Plants - A 'Reasonable Use' of the High Seas,
W79-04436 6E

BLAYLOCK, B. G.
Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

BLISS, J. D.
Radium-226 in Ground Water of West Central Florida,
W79-04065 5B

BOERSMA, L.
Experimental Evaluation of Chemical Transport in Water-Saturated Porous Media: 2. Sorbing Media,
W79-04014 5A

BOGGS, D. B.
Projecting Urban Runoff Flows and Loads,
W79-04050 5B

BOGGS, H. L.
Design and Analysis of Auburn Dam, Volume Five: Summary and Conclusions,
W79-04274 8A

Design and Analysis of Auburn Dam, Volume Four Appendices: Dynamic Studies,
W79-04273 8A

Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

Design and Analysis of Auburn Dam, Volume Four Supplement: Dynamic Studies,
W79-04272 8A

Design and Analysis of Auburn Dam, Volume One: Design Data,
W79-04268 8A

Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Two: Foundation Studies,
W79-04269 8A

BOIKO, A. V.
Washing of Unbleached Kraft Pulp with Effluents (Promyvka sul'fatnoi nebelenoi tsellyulozy stochnymi vodami),
W79-04423 3E

BORTON, D. L.
A Study of the Fate of Suspended Solids from a Full-Scale Treatment Plant in Receiving Waters,
W79-04225 5B

BOSTER, M. A.
Economic Analysis of the Conjunctive Use of Surface Water and Ground Water of Differing Prices and Qualities: A Coming Problem for Arizona Agriculture,
W79-04104 6B

BOWDEN, M. J.
Desertification of The Great Plains: Will it Happen,
W79-04285 2A

BOWERS, C. E.
Computer Programs in Water Resources,
W79-04081 7C

BOWLES, D. S.
Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

BOWLES, G. F.
Design and Analysis of Auburn Dam, Volume Five: Summary and Conclusions,
W79-04274 8A

Design and Analysis of Auburn Dam, Volume Four Appendices: Dynamic Studies,
W79-04273 8A

Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

Design and Analysis of Auburn Dam, Volume Four Supplement: Dynamic Studies,
W79-04272 8A

Design and Analysis of Auburn Dam, Volume One: Design Data,
W79-04268 8A

Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Two: Foundation Studies,
W79-04269 8A

BOWMAN, R. A.
Greenhouse Evaluation of Residual Phosphate by Four Phosphorus Methods in Neutral and Calcareous Soils,
W79-04178 2K

BOYD, M. J.
A Storage-Routing Model Relating Drainage Basin Hydrology and Geomorphology,
W79-04222 2E

BRANDWYK, J. F.
An Acoustic Probe for Precise Determination of Deep Water Levels in Boreholes,
W79-04241 7B

BRIDGEMAN, J. C.
Balancing the Interests. The Third Un-Law of the Sea Conference - (7th Session),
W79-04441 6E

BRITTON, P.
Geothermal Goes East,
W79-04248 3C

BROWER, D.
Access to the Nation's Beaches: Legal and Planning Perspectives,
W79-04448 6A

BRUA, S. A.
Floods of July 19-20, 1977, in the Johnstown Area, Western Pennsylvania,
W79-04413 2E

BRYAN, M. L.
Which Way to the Beach. Public Access to Beaches for Recreational Use,
W79-04435 6E

BRYDEN, H. L.
Mean Upwelling Velocities on the Oregon Continental Shelf During Summer 1973,
W79-04059 2L

BUCHANAN, G. A.
Distribution of Arsenic in Soil Profiles After Repeated Applications of MSMA,
W79-04085 5B

BUHLER, D. R.
The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5E

BUIKEMA, A. L. JR.
Development and Assessment of Acute Bioassay Techniques for the Littoral Rotifer, Philodina acuticornis,
W79-04120 5A

BULAT, J. A.
Inhibition of Urease Activity by Heterocyclic Sulfur Compounds,
W79-04233 2K

BULLER, W.
Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

BURMAN, M. E. III.
Effects of Alum Water Treatment Sludge on Domestic Wastewater Sludges,
W79-04116 5D

BUSCH, J. R.
Obtaining Specifications for Minimum Cost Irrigation Systems,
W79-04012 6A

BUSH, P. W.
Hydrologic Evaluation of Part of Central Volusia County, Florida,
W79-04030 4B

CADBURY, C. J.
Firth of Forth Oil Pollution Incident, February 1978,
W79-04316 5B

CAIRNS, J. JR.
Development and Assessment of Acute Bioassay Techniques for the Littoral Rotifer, Philodina acuticornis,
W79-04120 5A

CALANDRO, A. J.
Time of Travel of Solutes in Louisiana Streams,
W79-04401 5B

CALLENDER, E.
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

CAMPBELL, L. H.
Firth of Forth Oil Pollution Incident, February 1978,
W79-04316 5B

CANTON, S. P.
Environmental Effects of Western Coal Surface Mining, Part II: The Aquatic Macroinvertebrates of Trout Creek, Colorado,
W79-04252 5C

CAREY, W. P.
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

CARLSON, D. D.
Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

CAROTHERS, W. W.
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

CARSON, D. B.
Power Generation and Potable Water Recovery from Salinous Water,
W79-04468 3A

CARSWELL, W. J. JR.
Hydrologic Data for Soldier Creek Basin, Kansas,
W79-04026 7C

CASSEL, D. K.
Transport of Microorganisms in Sand Columns,
W79-04211 2I

CAVALLARO, J. I.
Small Mammal Habitat in Different-Aged Chamise-Wedgeleaf Ceanothus Chaparral,
W79-04259 4A

CAVALLARO, N.
Copper and Cadmium Adsorption Characteristics of Selected Acid and Calcareous Soils,
W79-04210 2K

CERCO, C. F.
Non-Point Source Pollution Studies in the Chincoteague Bay System,
W79-04488 5B

CHADDERTON, R. A.
A Model of the Behavior of pH Determining Parameters in Impoundments,
W79-04064 5B

CHAMPNEY, L.
Institutional Aspects of Water Resources Management at Substate Level,
W79-04309 6E

CHANESMAN, S.
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

CHANG, Y. C.
Intake Screenwell Surging Caused by Wave Dynamics,
W79-04357 8A

CHAPMAN, G. A.
Acutely Lethal Levels of Cadmium, Copper, and Zinc to Adult Male Coho Salmon and Steelhead,
W79-04340 5C

Toxicities of Cadmium, Copper, and Zinc to Four Juvenile Stages of Chinook Salmon and Steelhead,
W79-04339 5C

CHARACKLIS, W. G.
Stormwater Analysis and Prediction in Houston,
W79-04052 5B

CHARUDATTAN, R.
Biological Control of Water Weeds with Plant Pathogens,
W79-04311 4A

CHAUDHRY, F. H.
Nonuniform Sprinkler Irrigation Application Efficiency,
W79-04176 3F

CHEATHAM, G. W.
Report on Cibola Division (6) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04105 6B

Report on Imperial Division (7) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04106 6B

Report on Laguna Division (8) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04107 6B

CHERRY, D. S.
Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

CHEW, K. K.
Cladoceran Survival Studies in a Kraft Pulp Mill Aerated Stabilization Basin,
W79-04111 5D

CHICHESTER, F. W.
Disposition of 15N-Labeled Fertilizer Nitrate Applied During Corn Culture in Field Lysimeters,
W79-04223 3F

CHILDERS, J. M.
Channel Erosion Surveys Along the Taps Route, Alaska 1977,
W79-04411 2J

CHORLEY, D. W.
An Iterative Quasi-Three-Dimensional Finite Element Model for Heterogeneous Multiaquifer Systems,
W79-04125 2F

CHOSSIAKOS, A.
Green River Data Base System,
W79-04009 4A

CHOU, W. L.
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

CHRISTENSEN, B. A.
A Generalized Point-Velocity Method for Discharge Computations in Tidal Waterways,
W79-04378 2L

CHU, CHUNG SANG
Computer Programs in Water Resources,
W79-04081 7C

CHU, W. S.
A Nonlinear Programming Algorithm for Real-Time Hourly Reservoir Operations,
W79-04482 6B

CLEMMENS, A. J.
New Flume Breakthrough for Ditch Irrigators,
W79-04169 3F

CLUFF, C. B.
Asphalt-Crumb Rubber Waterproofing Membrane,
W79-04182 8G

COLLINS, D. D.
Simultaneous Treatment of SO2 Containing Stack Gases and Waste Water,
W79-04480 5D

COLON-DIEPPA, E.
Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

COLWELL, A. E.
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

CONTRACTOR, D. N.
A Finite Element Hydrologic Model to Determine the Effect of Land Management Practices on Erosion and Sedimentation in a Watershed,
W79-04091 4D

Hydrologic and Water Quality Modeling of Surface Water Discharges from Mining Operations,
W79-04134 6A

CONWAY, K. E.
Biological Control of Water Weeds with Plant Pathogens,
W79-04311 4A

COOK, D. R.
The Effect of Combined Soil Warming and Irrigation on the Soil Surface Energy Budget,
W79-04490 2G

COOK, F. D.
Inhibition of Urease Activity by Heterocyclic Sulfur Compounds,
W79-04233 2K

COOK, K. A.
A Neutron Activation Method for Determining Submicrogram Selenium in Forage Grasses,
W79-04235 2I

COOK, T. M.
Bacterial Metabolism of Arylsulfonates: Role of Meta Cleavage in Benzene Sulfonate Oxidation by Pseudomonas Testosteroni,
W79-04013 5D

COOLEY, M. E.
Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

COOLEY, R. L.
Finite Element Solution of Saint-Venant Equations,
W79-04100 10D

COON, N. C.
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

CORTNER, H. J.
Action Programs for Water Yield Improvement on Arizona's Watersheds: Political Constraints to Implementation,
W79-04093 6E

COSTA, H. S.
A Study of the Fate of Suspended Solids from a Full-Scale Treatment Plant in Receiving Waters,
W79-04225 5B

CROCKER, D. M.
Intake Screenwell Surging Caused by Wave Dynamics,
W79-04357 8A

CUNNINGTON, R. W.
Recent Effluent Color Reduction Trials at Alberni Pulp and Paper,
W79-04499 5D

CUSINE, D. J.
Liability for Oil Pollution Under the Merchant Shipping (Oil Pollution) Act 1971,
W79-04425 6E

DAGAN, G.
A Note on Packer, Slug, and Recovery Tests in Unconfined Aquifers,
W79-04128 2F

DAI, Y. B.
Flow Patterns Around Submerged Intake Structures for Power Plants,
W79-04356 8A

DALELA, R. C.
Toxicity of Textile Waste to Some Teleost Fishes,
W79-04341 5C

DANILOV, G. E.
Washing of Unbleached Kraft Pulp with Effluents (Promyvka sul'fatnoi nebelenoi tsellyulozy stochnymi vodami),
W79-04423 3E

DASBERG, S.
Denitrification in Four California Soils: Effect of Soil Profile Characteristics,
W79-04234 2G

DAUBERT, J.
Conjunctive Ground and Surface Water Allocations: The Economics of a Quasi-Market Solution,
W79-04078 6B

DAUER, D. M.
Effects of Non-Point Pollution on Benthic Invertebrates in the Lynnhaven River System,
W79-04071 5C

DAVIDSON, L. W.
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

DAVIS, E. M.
Ammonia in Texas Streams During Low Flow from Municipal Wastewater,
W79-04063 5B

Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

DAVIS, H. T.
Idaho's Environment (Problem of Unfettered Exploitation Rights v. Environmental Concern),
W79-04421 5D

DAVIS, R. B.
A Large-Volume Interstitial Water Sediment Squeezer for Lake Sediments,
W79-04098 2J

DE ALTERIS, J.
The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

DE GENNARO, N.
Agriculture: Its Historic and Contemporary Roles in Arizona's Economy,
W79-04281 6D

DE KLEMM, C.
Conservation and the New Informal Composite Negotiating Text of the Law of the Sea Conference,
W79-04440 6E

DEDRICK, A. R.
On-Farm Level-Basin Irrigation--Save Water and Energy,
W79-04177 3F

DEFORGE, S. M.
You Never Miss the Water ... Till the Well Runs Dry,
W79-04244 6D

DEVITT, D.
Transient Changes in the Soil-Water System from Irrigation with Saline Water: II. Analysis of Experimental Data,
W79-04205 2G

DEWALLE, D. R.
Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

DICKEY, E. C.
Wells and Ponds: Water Quality and Supply,
W79-04068 3C

DIETER, J. E. III.
Predicting Longitudinal Dispersion of Pollutants in Rivers,
W79-04365 5B

DIMICHELE, L.
Histopathological and Physiological Responses of Fundulus Heteroclitus to Napthalene Exposure,
W79-04312 5C

DINWIDDLE, D. E.
Behavior of a Micro Flowthrough Copper Ion-Selective Electrode System in the Millimolar to Submicromolar Concentration Range,
W79-04102 1A

DIRCK, C.
Federal Reserved Rights and the Interstate Allocation of Water,
W79-04346 6E

DIWAN, A. D.
Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

DIXON, J. B.
Adsorption of Aldicarb by Clays and Soil Organo-Clay Complexes,
W79-04217 2K

DOERKSEN, H. R.
Water Allocation: Constraints and Opportunities,
W79-04442 6E

DORRATCAGUE, D. E.
Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies,
W79-04359 2L

DOUGLAS, L. A.
Colorimetric Determination of Urea in Soil Extracts Using an Automated System,
W79-04228 2K

DOWNS, T. D.
Ammonia in Texas Streams During Low Flow from Municipal Wastewater,
W79-04063 5B

DRABLOS, C. J. W.
To Solve Highway and Farm Water Management Problems,
W79-04190 4C

DREGNE, H. E.
Desertification of Arid Lands,
W79-04287 2A

DREHER, K. J.
Design and Analysis of Auburn Dam, Volume Five: Summary and Conclusions,
W79-04274 8A

Design and Analysis of Auburn Dam, Volume Four Appendices: Dynamic Studies,
W79-04273 8A

Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

Design and Analysis of Auburn Dam, Volume Four Supplement: Dynamic Studies,
W79-04272 8A

Design and Analysis of Auburn Dam, Volume One: Design Data,
W79-04268 8A

Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Two: Foundation Studies,
W79-04269 8A

DRISCOLL, F.
Blasting-It Turns Dry Holes into Wet Ones
W79-04251 8A

DRORI, M.
Rotary Spraying Device Particularly Useful for Water Irrigation,
W79-04466 3F

DROST, B. W.
Water in the Skagit River Basin, Washington,
W79-04028 7C

DUBOSE, J. S.
The Economic Impact of Increased Forest and Farmland Beaver Damage in Mississippi,
W79-04074 2H

DUGAN, G. L.
Estimating Peak Discharges in Small Urban Hawaiian Watersheds for Selected Rainfall Frequencies, Kane'ohe Watershed, O'Ahu, Hawaii,
W79-04126 2B

DUNN, J. M.
Marketing of Surplus Water from Federal Reservoirs,
W79-04347 6E

DUPRAS, E. F. JR
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

DURUM, W. H.
Historical Profile of Quality of Water Laboratories and Activities, 1879--1973,
W79-04034 7B

EAGLESON, P. S.
Climate, Soil, and Vegetation--1. Introduction to Water Balance Dynamics,
W79-04037 2A

Climate, Soil, and Vegetation--2. The Distribution of Annual Precipitation Derived from Observed Storm Sequences,
W79-04038 2B

Climate, Soil, and Vegetation--3. A Simplified Model of Soil Moisture Movement in the Liquid Phase,
W79-04039 2G

Climate, Soil, and Vegetation--4. The Expected Value of Annual Evapotranspiration,
W79-04040 2D

Climate, Soil, and Vegetation--5. A Derived Distribution of Storm Surface Runoff,
W79-04041 2E

Climate, Soil, and Vegetation--6. Dynamics of the Annual Water Balance,
W79-04042 2A

Climate, Soil, and Vegetation--7. A Derived Distribution of Annual Water Yield,
W79-04043 2A

EDDY, A.
The Effects of Rain Gage Densities on the Analysis of Storm Total Rainfall from Convective Complexes,
W79-04108 2B

EDWARDS, M. D.
Status of the National Water Data Exchange (NAWDEX)--September 1978,
W79-04392 10A

EDWARDS, T.
Water Systems and Their Emergencies,
W79-04497 6B

EGGBORO, M. D.
Ground Water of the Island of Montreal, Canada,
W79-04060 2F

EHRLER, W. L.
Growth and Yield of Jojoba Plants in Native Stands Using Runoff-Collecting Microcatchments,
W79-04288 3F

ELLIS, S. R.
Trace Elements in Runoff from Rainfall and Snowmelt at Several Localities in the Denver, Colorado, Metropolitan Area,
W79-04019 5B

ENGEL, D. W.
Toxicity of Cupric Ion to Eggs of the Spot Leiostomus Xanthurus and the Atlantic Silverside Menidia Menidia,
W79-04314 5C

ENGELKE, M. J. JR.
Wyoming's Speckled Dace,
W79-04408 5A

ERICKSON, L. E.
Transient Temperature Effects on BOD and DO Concentrations Along a Stream,
W79-04087 5G

ERICSON, R. K.
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

ERIE, L. J.
On-Farm Level-Basin Irrigation--Save Water and Energy,
W79-04177 3F

EVANS, J. A.
Federal Water Pollution Control Act Discharge Permit System - An Industrial Viewpoint,
W79-04454 6E

EVANS, R. L.
An Assessment of Water Quality in the Spoon River, Part 1,
W79-04048 5A

An Assessment of Water Quality in the Spoon River, Part 2,
W79-04047 5A

EVISON, L. M.
Further Studies on Bifidobacteria as Indicators of Faecal Pollution in Water,
W79-04328 5A

FAGIN, H.
Water Systems and Their Emergencies,
W79-04497 6B

FAN, L. T.
Transient Temperature Effects on BOD and DO Concentrations Along a Stream,
W79-04087 5G

FANG, C. S.
Non-Point Source Pollution Studies in the Chincoteague Bay System,
W79-04488 5B

FAYE, R. E.
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

FESTA, J. F.
Turbidity Maxima in Partially Mixed Estuaries: A Two-Dimensional Numerical Model,
W79-04058 2L

FINK, D. H.
Growth and Yield of Jojoba Plants in Native Stands Using Runoff-Collecting Microcatchments,
W79-04288 3F

FINSTEIN, M. S.
Distribution of Autotrophic Nitrifying Bacteria in a Polluted River (The Passaic),
W79-04070 5B

FISCHBACH, P.
Irrigate--A Scheduling Model,
W79-04188 3F

FISCHBACH, P. E.
Basic Irrigation Scheduling Procedures,
W79-04171 3F

FISHER, J. S.
Transportation of Organic Detritus in Estuaries,
W79-04388 2L

FLAGGE, B.
Septic System Liquid Level Control Apparatus,
W79-04481 5D

FLAIG, W.
Colorimetric Determination of Urea in Soil Extracts Using an Automated System,
W79-04228 2K

FLEMER, D. A.
Carbon Requirements of a Population of the Estuarine Copepod Eurytemora Affinis,
W79-04011 2L

FLINT, R. W.
Elutriate-Primary Productivity Bioassays of Dredge Spoil Disposal in Lake Erie,
W79-04329 5B

FOCHT, D. D.
Denitrification in Four California Soils: Effect of Soil Profile Characteristics,
W79-04234 2G

FOK, A. T. K.
Wave Runup on Irregular Beach Profiles,
W79-04362 2L

FOSTER, H. S. JR.
A Cross-Sectional Investigation of the Determinants of Urban Residential Water Demand in the United States, 1960 and 1970,
W79-04003 6D

FRANK, P. M.
The Influence of Salinity on Toxicity of Cadmium and Chromium to the Blue Crab, Callinectes Sapidus,
W79-04319 5C

FRASER, R. S.
Earth-Atmosphere Systems and Surface Reflectivities in Arid Regions from LANDSAT MSS Data,
W79-04297 2A

FREAD, D. L.
Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

FREEMAN, T. E.
Biological Control of Water Weeds with Plant Pathogens,
W79-04311 4A

FRENCH, R. H.
Modification of the Chezy Roughness Coefficient by Density Stratification,
W79-04373 8B

The Stability of a Two Layer Flow Without Shear in the Presence of Boundary Generated Turbulence: Field Verification,
W79-04372 8B

FRENKEL, H.
Transient Changes in the Soil-Water System from Irrigation with Saline Water: I. Theory,
W79-04202 2G

FRENKEL, H.

Transient Changes in the Soil-Water System from Irrigation with Saline Water: II. Analysis of Experimental Data,
W79-04205 2G

FRIND, E. O.
An Iterative Quasi-Three-Dimensional Finite Element Model for Heterogeneous Multiaquifer Systems,
W79-04125 2F

Three-Dimensional Modeling of Groundwater Flow Systems,
W79-04149 2F

FRITTON, D. D.
Effect of Entrapped Soil Air on Infiltration,
W79-04124 2G

Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

FROBEL, R. K.
Asphalt-Crumb Rubber Waterproofing Membrane,
W79-04182 8G

FROSCH, R. A.
Simultaneous Treatment of SO2 Containing Stack Gases and Waste Water,
W79-04480 5D

FUGII, R.
The Complexing and Adsorption of Cadmium in Soils in the Presence of EDTA and NTA,
W79-04007 5B

FUSCO, R.
Method for the Purification of Sewage Waters Which Contain Organic Compounds of an Anionic Nature,
W79-04463 5D

GAGGIANI, N.
Limnological Characteristics of Cypress Lake, Upper Kissimmee River Basin, Florida,
W79-04025 2H

GAMMON, P.
Vegetative Communities of the Great Dismal Swamp: Identification and Mapping with Seasonal Color Infrared Photographs,
W79-04018 7B

GARDNER, W. R.
Water Uptake by Plants: I. Divided Root Experiments,
W79-04348 2I

Water Uptake by Plants: II. The Root Contact Model,
W79-04349 2I

GARTON, J. E.
Water Quality Improvement in Small Ponds,
W79-04261 5G

GASS, T. E.
Artificial Recharge: Part II,
W79-04239 4B

GATES, E. T.
The Squat Phenomenon and Related Effects of Channel Geometry,
W79-04375 8B

GEITZENAUER, K.
Foraminifera, Diatom and Bivalve Distribution in Recent Sediments of the Hudson Estuary,
W79-04056 2L

GEORGE, R. L.
Spillway Stilling Basin for Low Froude Flows,
W79-04355 8B

GIBBS, K. E.
A Record of Palaeodipteron Walkeri Ide (Diptera: Nymphomyiidae) from Maine: A Species and Family New to the United States,
W79-04265 6G

GILLESPIE, M. C.
A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

GILLEY, J. R.
Irrigate--A Scheduling Model,
W79-04188 3F

GILLIAM, J. W.
Denitrification in Four California Soils: Effect of Soil Profile Characteristics,
W79-04234 2G

GIVENS, M. R.
A Hydraulic Model Study of Propeller-Type Lake Destratification Pumps,
W79-04079 2H

GNIESER, J.
Apparatus and Process for Treating Contaminated Water,
W79-04477 5D

GONZALEZ, R.
Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

GOOD, R. E.
Biomass and Primary Production in Freshwater Tidal Wetlands of the Middle Atlantic Coast,
W79-04485 2I

GOPALAKRISHNAN, T. C.
Comparison of Numerical Simulation Flow Models for Coastal Inlets,
W79-04352 2L

GORDON, R. B.
A Three-Dimensional Numerical Model of Estuarine Circulation,
W79-04354 2L

GORHAM, E.
Fossil Pigments in Minnesota Lake Sediments and Their Bearing Upon the Balance between Terrestrial and Aquatic Inputs to Sedimentary Organic Matter,
W79-04129 2H

GOSZ, J. R.
Nitrogen Inputs to Stream Water from Forests Along an Elevational Gradient in New Mexico,
W79-04498 2I

GOULD, W. D.
Inhibition of Urease Activity by Heterocyclic Sulfur Compounds,
W79-04233 2K

GRAHAM, E. R.
A Neutron Activation Method for Determining Submicrogram Selenium in Forage Grasses,
W79-04235 2I

GRAHAM, G.
Balancing the Interests. The Third Un-Law of the Sea Conference - (7th Session),
W79-04441 6E

GRAHAM, P. J.
Aquatic Environmental Analysis in the Lower Yellow-Stone River,
W79-04276 6G

GRAIG, G. S. JR
Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

GRAY, W. G.
Ammonia in Texas Streams During Low Flow from Municipal Wastewater,
W79-04063 5B

GREEN, J. M.
Assessing Nonpoint Water Quality for Small Streams,
W79-04051 5B

The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

GREENLEAF, J. W. JR.
Sewage Treatment System,
W79-04473 5D

GREEY, G. W.
Report on Cibola Division (6) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04105 6B

Report on Imperial Division (7) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04106 6B

Report on Laguna Division (8) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04107 6B

GREIF, R.
Turbulent Transport to a Rotating Cylinder,
W79-04486 3A

GRENNEY, W. J.
Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

GRICE, R. H.
Ground Water of the Island of Montreal, Canada,
W79-04060 2F

GRIERSON, I. T.
A Rainfall Simulator for Field Studies of Runoff and Soil Erosion,
W79-04289 2B

GRIFFEN, W. L.
External Costs of Land Subsidence in the Houston-Baytown Area,
W79-04015 2F

GRIGG, N. S.
Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part I,
W79-04109 4A

Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part II,
W79-04110 4A

GRIMWOOD, C.
Diffusion of Dredged Material in the Mississippi River,
W79-04384 5B

GUIN, J. A.
Mass Transfer in Nonuniform Packing,
W79-04127 8G

GULLIKSEN, B.
Rocky Bottom Fauna in a Submarine Gulley at Loppkalven, Finnmark, Northern Norway,
W79-04057 2L

GUPTA, J. P.
Water Economy and Saline Water Use by Drip Irrigation,
W79-04303 3F

GUPTA, P. K.
Alteration in the Activities of Three Peptidases and Lipase in the Digestive System of the Fish Channa Punctatus Exposed to Lead Nitrate,
W79-04345 5C

GUTHRIE, R. K.
Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

GUTIERREZ, L. A.
Toxicity Removed by Foam Separation,
W79-04254 5D

HAJAS, L.
Projecting Urban Runoff Flows and Loads,
W79-04050 5B

HAJEK, B. F.
Distribution of Arsenic in Soil Profiles After Repeated Applications of MSMA,
W79-04085 5B

HALGREEN, C.
Some Errors in Precipitation Measurements,
W79-04088 2B

HALL, J. K.
Atrazine Mobility in Two Soils Under Conventional Tillage,
W79-04212 2G

HAMDY, M. K.
Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

HAMILTON, M.
Extractability of 238Pu and 242Cm from a Contaminated Soil as a Function of pH and Certain Soil Components: HNO3-NaOH System,
W79-04236 2G

HAMMETT, K. M.
Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

HAMPICKE, U.
Agriculture and Conservation--Ecological and Social Aspects,
W79-04164 3F

HANSEN, D. V.
Turbidity Maxima in Partially Mixed Estuaries: A Two-Dimensional Numerical Model,
W79-04058 2L

HANSIS, R. A.
Land Tenure, Hazards, and the Economy: Viticulture in the Mendoza Oasis, Argentina,
W79-04291 3F

HARDEE, J.
Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

HARDEN, T. O.
The Effect of Ice Cover on Vertical Tranfer in Stream Channels,
W79-04062 2E

HARDIN, C. W.
Testing Social Indicators in the Techcom Model for Water Development,
W79-04491 6A

HARLIN, J. M.
Reservoir Sedimentation as a Function of Precipitation Variability,
W79-04061 4D

HARMS, V. W.
Diffraction of Waves by A Shore-Connected Breakwater,
W79-04377 8B

HARNED, D. A.
Stormwater Analysis and Prediction in Houston,
W79-04052 5B

HARP, J. F.
The Role of Streams in Pollution Dilution and Dispersion,
W79-04118 5B

HARSH, J. F.
Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

HART, E. D.
Prototype Reaeration Measurements, Beltzville Dam, Pennsylvania,
W79-04380 5G

HARTMANN, V. J.
Growth of Fishes During Oligo-, Meso, and Eutrophic Status of Lake Constance (Fischwachstum Bei Oligo-, Meso- und Eutrophie Des Bodensees),
W79-04336 5C

HARTWIG, N. L.
Atrazine Mobility in Two Soils Under Conventional Tillage,
W79-04212 2G

HASHIMOTO, K.
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

HASKIN, H. H.
Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

HAVLICEK, J. JR.
The Effects of Inland Navigation User Charges on Barge Transportation of Wheat,
W79-04075 6C

HAWKINS, R. H.
Salt Pickup by Overland Flow in the Price River Basin, Utah,
W79-04298 2E

HAYES, R. O.
Irrigation Management Service and Mosquito Control,
W79-04175 3F

HAYTER, E. J.
A Generalized Point-Velocity Method for Discharge Computations in Tidal Waterways,
W79-04378 2L

HEALY, H. G.
Water Levels in Artesian and Nonartesian Aquifers of Florida, 1975-76,
W79-04404 2F

HECHT, M. E.
Agriculture: Its Historic and Contemporary Roles in Arizona's Economy,
W79-04281 6D

HEINLE, D. R.
Carbon Requirements of a Population of the Estuarine Copepod Eurytemora Affinis,
W79-04011 2L

HEMBREE, L.
The Effects of Rain Gage Densities on the Analysis of Storm Total Rainfall from Convective Complexes,
W79-04108 2B

HENDRICKSON, R. L.
Drip Irrigation Emitter,
W79-04467 3F

HENRY, C.
How Idaho Irrigators Trim Back Power Costs,
W79-04186 3F

HENRY, H. R.
Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

HENRY, R. E.
Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

HERBICH, J. B.
Major Port Improvement Alternatives,
W79-04376 8B

Productive Land Use of Dredged Material Containment Areas,
W79-04385 5E

The Squat Phenomenon and Related Effects of Channel Geometry,
W79-04375 8B

Velocity Distribution and Sediment Motion Induced by Ship's Propeller in Ship Channels,
W79-04374 8B

HERKELRATH, W. N.
Water Uptake by Plants: I. Divided Root Experiments,
W79-04348 2I

Water Uptake by Plants: II. The Root Contact Model,
W79-04349 2I

HERRICKS, E. E.
Hydrologic and Water Quality Modeling of Surface Water Discharges from Mining Operations,
W79-04134 6A

HEWITT, K.
Desertification, Development, and the 'Admirals' of Manchar Lake in Sind, Pakistan,
W79-04292 8I

HIDU, H.
Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

HIGER, A. L.
Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

HILLER, R. L.
Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part I,
W79-04109 4A

Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part II,
W79-04110 4A

HILTBOLD, A. E.
Distribution of Arsenic in Soil Profiles After Repeated Applications of MSMA,
W79-04085 5B

HINGORANI, H. G.
Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

HIRA, G. S.
Prediction of Phosphorus Diffusion from Fertilizer Source,
W79-04208 2K

HO, D. S. N.
Marine Receiving Water Monitoring Program for Pulp Mill Effluent (Of Canadian Cellulose Co. Ltd.) at Prince Rupert,
W79-04416 5A

HOSSNER, L. R.
Effects of Evaporative Salt Water Cooling Towers on Salt Drift and Salt Deposition on Surrounding Soils,
W79-04220 5B

HOUSTON, C. W.
Microbial Growth on Hydrocarbons -- Some Experimental Results,
W79-04101 5A

HOWELLS, D. H.
Urban Flood Management: Problems and Research Needs,
W79-04089 4A

HSIEH, Y. P.
Suspended Solids Carried by the Gallatin River of Southwestern Montana: II. Using Mineralogy for Inferring Sources,
W79-04099 2J

HSUEH, S. F.
Mixing in Shallow Coastal Sea: Case Study,
W79-04049 5B

HUBBARD, B. S.
Productive Land Use of Dredged Material Containment Areas,
W79-04385 5E

HUBBARD, T. J.
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

HUCKABEE, J. W.
Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

HULL, J. A.
Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

HUMENIK, F. J.
208 Water Quality Planning How it Will Affect You,
W79-04193 6E

HUMPHREY, J. H.
Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies,
W79-04359 2L

HUMPHREYS, A.
Float Valves Improve Pipeline Systems,
W79-04184 3F

HUNDLEY, N.
Special Water Rights for Indians: Principle Versus Confusion,
W79-04121 6E

HUNT, S.
Sedimentation Rates in Lake Champlain Since Settlement by Man,
W79-04308 2J

HUNTER, J. S. III.
A Basis for Aeration Design,
W79-04002 5D

HUNTINGTON, G. L.
Erosion Prediction on California Rangeland: Research Developments and Needs,
W79-04487 4D

IGUCHI, M.
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

JACKSON, U. T.
Simazine Residues in Canal Water and Crops Resulting from Experimental Application for Ditchbank Weed Control,
W79-04267 5B

JACUZZI, D.
Water Systems Council: A Variety of Services to Pump Manufacturers and the Water Well Industry,
W79-04240 4B

JAGER-FORGET, E.
Limiting the Costs of Pollution Control: Treatment of Effluents at the Source (Limitation du cout de la depollution: traitement des effluents a la source),
W79-04221 5D

JANSEN, E. F. JR.
Hill Reestablishment: Retrospective Community Study of a Relocated New England Town,
W79-04158 6B

JANZEN, S. A.
Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

JARRETT, A. R.
Effect of Entrapped Soil Air on Infiltration,
W79-04124 2G

JATEN, A.
Report on Cibola Division (6) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04105 6B

Report on Imperial Division (7) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04106 6B

Report on Laguna Division (8) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04107 6B

JENNINGS, M. S.
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

JERKINS, P.
A Set of Coordinated Mathematical Models for the Coastal Zone,
W79-04353 2L

JIMENEZ, R. A.
Asphalt-Crumb Rubber Waterproofing Membrane,
W79-04182 8G

JOHNSON, D. A.
A Technique for Assessing Seedling Emergence Under Drought Stress,
W79-04280 3F

JOHNSON, K.
Disintegration of a Traditional Resource-Use Complex: The Otomi of the Mezquital Valley, Hidalgo, Mexico,
W79-04293 6G

JOHNSON, R.
The CAP - An Engineering Marvel,
W79-04294 8A

JONES, L. L.
External Costs of Land Subsidence in the Houston-Baytown Area,
W79-04015 2F

JUDY, R. D. JR.
The Acute Toxicity of Copper to Gammarus Fasciatus Say, A Freshwate Amphipod,
W79-04342 5C

JUO, A. S. R.
Retention and Leaching of Nutrients in a Limed Ultisol Under Cropping,
W79-04500 5B

JURINAK, J. J.
Multicomponent Cation Adsorption During Convective-Dispersive Flow Through Soils: Experimental Study,
W79-04218 2K

JURY, W. A.
Transient Changes in the Soil-Water System from Irrigation with Saline Water: I. Theory,
W79-04202 2G

Transient Changes in the Soil-Water System from Irrigation with Saline Water: II. Analysis of Experimental Data,
W79-04205 2G

KAESLER, R. L.
Fortran IV Program to Compute Diversity Indices from Information Theory,
W79-04262 10D

Fortran IV Program to Compute Hierarchical Diversity,
W79-04264 10D

Fortran IV Program to Compute Replicated Diversity Indices for Random Samples of Specified Size,
W79-04263 10D

KAFKAFI, U.
Phosphate Desorption from Kaolinite Suspensions,
W79-04207 2K

KAFRI, U.
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

KAMIYA, H.
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

KAMMEL, R.
Method and Apparatus for Treating Metal Containing Waste Water,
W79-04478 5D

KANEMASU, E. T.
Irrigation Water Movement Below the Corn Root Zone in Crete Silt Loam,
W79-04483 2G

KARDOS, L. T.
Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

KARMELI, D.
Distribution Patterns and Losses for Furrow Irrigation,
W79-04181 3F

KAUFMANN, R. F.
Radium-226 in Ground Water of West Central Florida,
W79-04065 5B

KAWATA, K.
Relationship Between Indicator Organisms and Selected Pathogenic Bacteria in Urban Waterways,
W79-04330 5A

KAYNOR, E. R.
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

KAZMANN, R.
Waste Surveillance in Subsurface Disposal Projects,
W79-04097 5E

KEADY, D. M.
Dynamics of Wave-Induced Currents in Sediments,
W79-04076 2J

KENNEDY, J. J.
Multiple Use of Irrigation Canals,
W79-04096 6D

KHARAKA, Y. K.
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

KHERA, R. P.
ASCE Met Section Striving to Make Civil Engineering Curricula More Practice-Oriented,
W79-04189 9A

KILBURN, J. S.
Water Purification with Fragmented Oil Shale,
W79-04465 5D

KIMBALL, J. D.
Alaska Oil Discharge Prevention and Pollution Control Act Held Invalid Chevron U.S.A. Inc. v. Hammond,
W79-04424 6E

KIMBALL, L.
Balancing the Interests. The Third Un-Law of the Sea Conference - (7th Session),
W79-04441 6E

KING, K. A.
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

KING, W. S.
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

KISSEL, D. E.
Fate of Fertilizer Nitrate Applied to Coastal Bermudagrass on a Swelling Clay Soil,
W79-04215 2K

KLAGES, M. G.
Suspended Solids Carried by the Gallatin River of Southwestern Montana: II. Using Mineralogy for Inferring Sources,
W79-04099 2J

KLECKNER, R. L.
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

KLEMKA, D. L.
Electric Power Development in the Pacific Northwest Region: Institutional Commitments and Alternatives, Phase 2,
W79-04159 6E

KNIEVEL, D. P.
Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

KOHBERGER, R. C.
A Method for Parameter Sensitivity Analysis in Differential Equation Models,
W79-04229 6A

KOHOUT, F. A.
Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

KOLIPINSKI, M. C.
Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

KONRAD, K.
The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

KOTHANDARAMAN, V.
An Assessment of Water Quality in the Spoon River, Part 1,
W79-04048 5A

An Assessment of Water Quality in the Spoon River, Part 2,
W79-04047 5A

KRAMER, M. A.
Design and Analysis of Auburn Dam, Volume Five: Summary and Conclusions,
W79-04274 8A

Design and Analysis of Auburn Dam, Volume Four Appendices: Dynamic Studies,
W79-04273 8A

Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

Design and Analysis of Auburn Dam, Volume Four Supplement: Dynamic Studies,
W79-04272 8A

Design and Analysis of Auburn Dam, Volume One: Design Data,
W79-04268 8A

Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Two: Foundation Studies,
W79-04269 8A

KREULA, J.
Enso-Biox Method for Deodorization and Detoxification of Waste Waters,
W79-04295 5D

KRISHNAMURTHI, N.
On Oscillation of Numerical Solution of a Modified Richards' Equation,
W79-04231 2G

KROLL, J.
The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

KRUGMANN, H. G.
Process for Treating Sewage, Particularly on Ships,
W79-04470 5D

KRUSE, C. W.
Relationship Between Indicator Organisms and Selected Pathogenic Bacteria in Urban Waterways,
W79-04330 5A

KUWABARA, K.
Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

LACEWELL, R. D.
Economically Optimum Irrigation Patterns for Grain Sorghum Production: Texas High Plains,
W79-04495 3F

External Costs of Land Subsidence in the Houston-Baytown Area,
W79-04015 2F

LAI, C.
Some Practical Techniques of Two-Dimensional Interpolation in Computational Hydraulics,
W79-04368 8B

LAI, S-H.
Multicomponent Cation Adsorption During Convective-Dispersive Flow Through Soils: Experimental Study,
W79-04218 2K

LAKSHMANAN, R.
Analysis of Practicability of a Solution to the Problem of Pollution by Spent Liquors (Analyse de practicabilite d'une solution au probleme de la pollution par les liqueurs residuelles),
W79-04400 5D

LAKSHMINARAYAN, S.
Analysis of Practicability of a Solution to the Problem of Pollution by Spent Liquors (Analyse de practicabilite d'une solution au probleme de la pollution par les liqueurs residuelles),
W79-04400 5D

LANGLOIS, M.
Experience with the Operation of an Effluent Clarifier (Experience d'operation d'un clarificateur d'effluents),
W79-04305 5D

LARSEN, R.
Irrigation Piep Repair Cuts Costs,
W79-04185 8A

Limited Irrigation Tests Get Results,
W79-04187 3F

LARSON, S. P.
Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

LAW, A. G.
Application of a Version of the Stanford Model to a Small Piedmont Watershed,
W79-04086 2A

LAZARUS, R. J.
Nonpoint Source Pollution,
W79-04443 5A

LEE, K. N.
Electric Power Development in the Pacific Northwest Region: Institutional Commitments and Alternatives, Phase 2,
W79-04159 6E

LEGETT, A. T. JR.
Effects of Non-Point Pollution on Benthic Invertebrates in the Lynnhaven River System,
W79-04071 5C

LEMBKE, W. D.
Wells and Ponds: Water Quality and Supply,
W79-04068 3C

LENVIK, K.
Contents of Some Heavy Metals in Norwegian Rivers,
W79-04021 5A

LIEBER, H.
Method and Apparatus for Treating Metal Containing Waste Water,
W79-04478 5D

LIGON, J. T.
Application of a Version of the Stanford Model to a Small Piedmont Watershed,
W79-04086 2A

Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

LIN, S. H.
Transient Temperature Effects on BOD and DO Concentrations Along a Stream,
W79-04087 5G

LINDBERG, S. E.
Behavior and Transport of Mercury in River-Reservoir System Downstream of Inactive Chloralkali Plant,
W79-04290 5C

LINDSAY, W. L.
Development of a DTPA Soil Test for Zinc, Iron, Manganese, and Copper,
W79-04179 2K

LINDSLEY, E. F.
Ground-Heat-Assisted Heat Pumps,
W79-04243 8C

LINDSTROM, F. T.
Experimental Evaluation of Chemical Transport in Water-Saturated Porous Media: 2. Sorbing Media,
W79-04014 5A

LIOU, Y-C.
Velocity Distribution and Sediment Motion Induced by Ship's Propeller in Ship Channels,
W79-04374 8B

LITTLER, M. M.
Influence of Domestic Wastes on Energetic Pathways in Rocky Intertidal Communities,
W79-04133 5C

LIU, H.
Predicting Longitudinal Dispersion of Pollutants in Rivers,
W79-04365 5B

LOEFFLER, R. M.
Channel Erosion Surveys Along the Taps Route, Alaska 1977,
W79-04411 2J

LOMBARD, R. E.
Water in the Skagit River Basin, Washington,
W79-04028 7C

LONGENBAUGH, R. A.
On Oscillation of Numerical Solution of a Modified Richards' Equation,
W79-04231 2G

LOPEZ, N. C.
Estimating Peak Discharges in Small Urban Hawaiian Watersheds for Selected Rainfall Frequencies, Kane'ohe Watershed, O'Ahu, Hawaii,
W79-04126 2B

LOREFICE, G. J.
Elutriate-Primary Productivity Bioassays of Dredge Spoil Disposal in Lake Erie,
W79-04329 5B

LORIO, W. J.
Movements of Largemouth Bass (Micropterus Salmoides) in Impounded Waters as Determined by Underwater Telemetry,
W79-04016 2H

LUND, L. J.
Denitrification in Four California Soils: Effect of Soil Profile Characteristics,
W79-04234 2G

LYSTROM, D. J.
Data Needs in Urban Hydrology,
W79-04409 7A

MABBUTT, J. A.
Perspectives on Desertification,
W79-04282 3F

MACHEMEHL, J. L.
Comparison of Numerical Simulation Flow Models for Coastal Inlets,
W79-04352 2L

MACK, F. K.
Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

MADDOCK, T. III
Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

MADSEN, G. E.
Testing Social Indicators in the Techcom Model for Water Development,
W79-04491 6A

MAFFET, V.
Organic Waste Drying Process,
W79-04464 5D

MAHAJAN, O. P.
Surface-Treated Activated Carbon for Removal of Ammonia from Water.
W79-04132 5D

MALANEY, G. W.
Rapid Method for Determining Numbers of Sewage Pollution Bacteria (e.g., Coliforms) in Water,
W79-04389 5A

MALONEY, F. E.
Drawing the Line at the Oceanfront: The Role of Coastal Construction Setback Lines in Regulating Development of the Coastal Zone,
W79-04432 2J

MANDLE, R. J.
Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

MARCHE, C.
Wave Runup on Irregular Beach Profiles,
W79-04362 2L

MARSHALL, S. L.
Index to Water-Resources Data for Louisiana, Ground-Water Records,
W79-04412 7C

MARTIN, W. E.
Economic Analysis of the Conjunctive Use of Surface Water and Ground Water of Differing Prices and Qualities: A Coming Problem for Arizona Agriculture,
W79-04104 6B

MARTS, M. E.
Electric Power Development in the Pacific Northwest Region: Institutional Commitments and Alternatives, Phase 2,
W79-04159 6E

MASCARENHAS, A. C.
Resettlement and Desertification: The Wagogo of Dodoma District, Tanzania,
W79-04296 6A

MATTRAW, H. C. JR.
Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

MATULEWICH, V. A.
Distribution of Autotrophic Nitrifying Bacteria in a Polluted River (The Passaic),
W79-04070 5B

MATYSKIELA, W.
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

MCBRIDE, M. B.
Copper and Cadmium Adsorption Characteristics of Selected Acid and Calcareous Soils,
W79-04210 2K

MCCALLION, C. D.
Investigation of the Long-Term Effects of Chlorine on the Oxygen Demand of Wastewaters,
W79-04160 5D

MCCORMICK, J.
Biomass and Primary Production in Freshwater Tidal Wetlands of the Middle Atlantic Coast,
W79-04485 2I

MCCUTCHEON, S. C.
The Stability of a Two Layer Flow Without Shear in the Presence of Boundary Generated Turbulence: Field Verification,
W79-04372 8B

MCINTOSH, A. W.
Dual Purpose Detention Basins and Surveillance Procedures in Urbanizing Watersheds,
W79-04077 4C

MCKAY, G.
The Removal of Color from Effluent Using Various Adsorbents: Some Preliminary Economic Considerations,
W79-04253 5D

MCKEAN, J. R.
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

MCKEON, K.
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

MCKEOWN, J. J.
A Study of the Fate of Suspended Solids from a Full-Scale Treatment Plant in Receiving Waters,
W79-04225 5B

MCLAUGHLIN, D. K.
A Hydraulic Model Study of Propeller-Type Lake Destratification Pumps,
W79-04079 2H

MCNULTY, J. F. JR.
E. I. Dupont De Nemours & Co. v. Train - EPA Authority to set Industry Wide Effluent Limitations by Regulation,
W79-04439 6E

MCPHERSON, B. F.
Limnological Characteristics of Cypress Lake, Upper Kissimmee River Basin, Florida,
W79-04025 2H

MCWILLIAMS, E. L.
Effects of Evaporative Salt Water Cooling Towers on Salt Drift and Salt Deposition on Surrounding Soils,
W79-04220 5B

MEADOWS, M. E.
Assessing Nonpoint Water Quality for Small Streams,
W79-04051 5B

MEARS, A. I.
Flooding and Sediment Transport in a Small Alpine Drainage Basin in Colorado,
W79-04090 2J

MEHTA, A. J.
A Generalized Point-Velocity Method for Discharge Computations in Tidal Waterways,
W79-04378 2L

MELLISH, G. A.
Responses of Several Forage and Field Crops to Subsurface Soil Warming and Sewage Effluent Spray Irrigation,
W79-04489 3F

MERRELL, J. L.
A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

MES, M. J.
Improved Drag Force Linearizations for Structural Dynamic Calculations,
W79-04358 8B

MEYKAR, O. A.
Progress of Protection of the Environment and Resources in the United States-A Historical Survey,
W79-04278 6E

MIDDELBEEK, C. G.
Oil-Water Separator,
W79-04461 5G

MIH, W. C.
Hydraulic Restoration of Stream Gravel for Spawning and Rearing of Salmon Species,
W79-04260 8I

MILLER, E. E.
Water Uptake by Plants: I. Divided Root Experiments,
W79-04348 2I

Water Uptake by Plants: II. The Root Contact Model,
W79-04349 2I

MILLER, J.
Electrolytic Cell for Treatment of Water,
W79-04469 5F

MILLER, L. G.
Drain-Hole Drilling Can Increase Productivity,
W79-04249 8A

MILLER, R. A.
Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

MILLER, T. K.
Topological Classifications of Drainage Networks: An Evaluation,
W79-04232 2A

MINGO, T. M.
A Record of Palaeodipteron Walkeri Ide (Diptera: Nymphomyiidae) from Maine: A Species and Family New to the United States,
W79-04265 6G

MITCHELL, S. T.
Growth and Yield of Jojoba Plants in Native Stands Using Runoff-Collecting Microcatchments,
W79-04288 3F

MOENCH, A. F.
Transient Pressure Analysis in Geothermal Steam Reservoirs with an Immobile Vaporizing Liquid Phase--Summary Report,
W79-04410 1A

MOIN, S. A.
Finite Element Solution of Saint-Venant Equations,
W79-04100 10D

MONTES, J. G.
Spectrophotometricaly Assayed Inhibitory Effects of Mercuric Compounds on Anabaena Flos-Aquae and Anacystis Nidulans (Cyanophyceae),
W79-04327 5A

MORGAN, S.
Further Studies on Bifidobacteria as Indicators of Faecal Pollution in Water,
W79-04328 5A

Multiple Use of Irrigation Canals,
W79-04096 6D

MORRIS, G. R.
Asphalt-Crumb Rubber Waterproofing Membrane,
W79-04182 8G

MORRISON, T. P.
A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

MUELLER, J. C.
Toxicity Removed by Foam Separation,
W79-04254 5D

MULVANY, P. S.
Fortran IV Program to Compute Diversity Indices from Information Theory,
W79-04262 10D

Fortran IV Program to Compute Hierarchical Diversity,
W79-04264 10D

Fortran IV Program to Compute Replicated Diversity Indices for Random Samples of Specified Size,
W79-04263 10D

MURPHY, W. R. JR.
Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

MURRAY, H. E.
Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

MURRAY, S. N.
Influence of Domestic Wastes on Energetic Pathways in Rocky Intertidal Communities,
W79-04133 5C

MUSSALLI, Y. G.
Biological and Engineering Investigation of Angled Flush Fish Diversion Screens,
W79-04383 8I

Fish Return Systems,
W79-04381 8I

NAIDU, N. C.
Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

NARASIMHAN, T. N.
Finite Element Method for Subsurface Hydrology Using A Mixed Explicit-Implicit Scheme,
W79-04163 2F

NELSON, G. L.
Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska,
W79-04391 2F

NEUMAN, S. P.
Finite Element Method for Subsurface Hydrology Using A Mixed Explicit-Implicit Scheme,
W79-04163 2F

NEWELL, L. T.
Earthworm Populations, Soil Bulk Density, Porosity, and Water Stable Aggregates under Effluent Application,
W79-04005 5C

NG, K. S.
Toxicity Removed by Foam Separation,
W79-04254 5D

NICHOLS, W. J.
Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

NIELSEN, R. L.
Irrigation Management Service and Mosquito Control,
W79-04175 3F

NIEMANN, R. A.
Application of Ion Exchange Membranes to Sampling and Enrichment: Interference of Metal Ion Binding Groups,
W79-04103 1A

NISHITA, H.
Extractability of 238Pu and 242Cm from a Contaminated Soil as a Function of pH and Certain Soil Components: HNO3-NaOH System,
W79-04236 2G

NOBLE, J.
National Forests do not have Reserved Water Rights for Recreational Purposes,
W79-04417 6E

NOGUCHI, T.
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

NOON, K. F.
Bacterial Metabolism of Arylsulfonates: Role of Meta Cleavage in Benzene Sulfonate Oxidation by Pseudomonas Testosteroni,
W79-04013 5D

NORMAN, J. M.
Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

NORMAN, K. E.
Cladoceran Survival Studies in a Kraft Pulp Mill Aerated Stabilization Basin,
W79-04111 5D

NORTON, S. A.
A Large-Volume Interstitial Water Sediment Squeezer for Lake Sediments,
W79-04098 2J

NORVELL, W. A.
Development of a DTPA Soil Test for Zinc, Iron, Manganese, and Copper,
W79-04179 2K

NORVILLE, H. J.
Perceptions of Effective Public Participation in Water Resources Decision Making and Their Relationship to Levels of Participation,
W79-04493 6B

NUNES, P.
Acute Toxicity of the Water-Soluble Fraction of Cook Inlet Crude Oil to the Manila Clam,
W79-04323 5C

NYBERG, D.
The Effect of Temperature on Copper Tolerance of Paramecium,
W79-04343 5C

O'BRIEN, T.
The Use of Civil Penalties in Enforcing the Clean Water Act Amendments of 1977,
W79-04449 6E

O'CONNER, J. S.
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

O'DONNELL, A. J. JR.
Drawing the Line at the Oceanfront: The Role of Coastal Construction Setback Lines in Regulating Development of the Coastal Zone,
W79-04432 2J

OADES, J. M.
A Rainfall Simulator for Field Studies of Runoff and Soil Erosion,
W79-04289 2B

OGORODNIKOVA, N. V.
Washing of Unbleached Kraft Pulp with Effluents (Promyvka sul'fatnoi nebelenoi tsellyulozy stochnymi vodami),
W79-04423 3E

OLIN, D. A.
Flood Frequency of Small Streams in Alabama,
W79-04024 6A

OLIVIERI, V. P.
Relationship Between Indicator Organisms and Selected Pathogenic Bacteria in Urban Waterways,
W79-04330 5A

OLSEN, S. R.
Greenhouse Evaluation of Residual Phosphate by Four Phosphorus Methods in Neutral and Calcareous Soils,
W79-04178 2K

OLSON, B. R. JR.
Drip and/or Sprinkler,
W79-04192 3F

ONESTI, L. J.
Topological Classifications of Drainage Networks: An Evaluation,
W79-04232 2A

ORLOVSKY, N. S.
A Winning Battle Against Destruction,
W79-04284 3F

ORR, R. H.
The Additive and Interactive Effects of Powerlessness and Anomie in Predicting Opposition to Pollution Control,
W79-04010 5G

OTTERBURN, M. S.
The Removal of Color from Effluent Using Various Adsorbents: Some Preliminary Economic Considerations,
W79-04253 5D

OTTERMAN, J.
Earth-Atmosphere Systems and Surface Reflectivities in Arid Regions from LANDSAT MSS Data,
W79-04297 2A

OTTMERS, D. M. JR.
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

OTTO, N. E.
Simazine Residues in Canal Water and Crops Resulting from Experimental Application for Ditchbank Weed Control,
W79-04267 5B

OZSOY, E.
Tidal Jet Flows Near Inlets,
W79-04361 2L

PAPADOPULOS, S. S.
Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

PAPAGEORGIS, N.
The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

PAPINEAU, R. L.
Analysis of Practicability of a Solution to the Problem of Pollution by Spent Liquors (Analyse de practicabilite d'une solution au probleme de la pollution par les liqueurs residuelles),
W79-04400 5D

PAPPAS, A. C.
Contents of Some Heavy Metals in Norwegian Rivers,
W79-04021 5A

PARIZEK, R. R.
Carbonate Hydrogeologic Environments: Their Relationship to Land Use, Water Resources Development and Management,
W79-04494 4B

PARKER, C. A.
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

PARKER, C. E.
Wastewater Treatment for Small Rural Communities,
W79-04119 5D

PARR, J. L.
Escanaba's Environmental Systems: The First Five Years,
W79-04219 5D

PARRETT, C.
Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

PATRICK, W. H. JR.
The Distribution of Micronutrient Cations in Soil Under Conditions of Varying Redox Potential and pH,
W79-04214 2K

Residual Fertilizer Nitrogen in a Flooded Rice Soil,
W79-04237 2G

The Role of Nitrate Diffusion in Determining the Order and Rate of Denitrification in Flood Soil: I. Experimental Results,
W79-04130 2G

The Role of Nitrate Diffusion in Determining the Order and Rate of Denitrification in Flooded Soil: II. Theoretical Analysis and Interpretation,
W79-04131 2G

PELLONI, L.
Apparatus and Process for Treating Contaminated Water,
W79-04477 5D

PENKAL, R. F.
Aquatic Environmental Analysis in the Lower Yellow-Stone River,
W79-04276 6G

PENROSE, W. R.
The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

PERNIA, JOSE ELVECIO
Hydrologic Parameters from LANDSAT Imagery for Williams Fork Watershed,
W79-04073 5A

PERRET, D.
Planning for Water Resources,
W79-04152 6D

PHILLIPS, G. R.
The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5B

PHILLIPS, R. E.
The Role of Nitrate Diffusion in Determining the Order and Rate of Denitrification in Flood Soil: I. Experimental Results,
W79-04130 2G

The Role of Nitrate Diffusion in Determining the Order and Rate of Denitrification in Flooded Soil: II. Theoretical Analysis and Interpretation,
W79-04131 2G

PICKRAL, J. C.
Transportation of Organic Detritus in Estuaries,
W79-04388 2L

PONCE, S. L.
Salt Pickup by Overland Flow in the Price River Basin, Utah,
W79-04298 2E

PONCE, V. M.
Muskingum-Cunge Method with Variable Parameters,
W79-04122 2E

PORADEK, J. C.
Simultaneous Treatment of SO2 Containing Stack Gases and Waste Water,
W79-04480 5D

POST, F. J.
Life in the Great Salt Lake,
W79-04095 2H

POTTER, H. R.
Perceptions of Effective Public Participation in Water Resources Decision Making and Their Relationship to Levels of Participation,
W79-04493 6B

POWERS, W. L.
Irrigation Water Movement Below the Corn Root Zone in Crete Silt Loam,
W79-04483 2G

PRABHU, N. V.
Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

PRAHACS, S.
Physico-Chemical Techniques for Treating Mill Effluents: A State-of-the-Art Review,
W79-04256 5D

PRASAD, A. K.
A Case for Reappraisal of Indian Water Pollution Standards as Applicable to Pulp and Paper Industry,
W79-04255 6E

PRASHER, B. D.
Mass Transfer in Nonuniform Packing,
W79-04127 8G

PRESTWICH, S. M.
Drain-Hole Drilling Can Increase Productivity,
W79-04249 8A

PRINGLE, J. C.
Simazine Residues in Canal Water and Crops Resulting from Experimental Application for Ditchbank Weed Control,
W79-04267 5B

PUGLISI, R. L.
Bureau of Reclamation Required to Comply with California Water Allocation Procedures,
W79-04455 6E

PUNNETT, R. E.
Water Quality Improvement in Small Ponds,
W79-04261 5G

QUIMPO, R. G.
Projecting Urban Runoff Flows and Loads,
W79-04050 5B

RAINES, R. W.
Simazine Residues in Canal Water and Crops Resulting from Experimental Application for Ditchbank Weed Control,
W79-04267 5B

RALPH, E. J.
A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

RAMIREZ-MITCHELL, R.
Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

RANEY, R. J.
Irrigation Water Movement Below the Corn Root Zone in Crete Silt Loam,
W79-04483 2G

RAO, A. R.
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

Green River Data Base System,
W79-04009 4A

RASMUSSEN, K. R.
Some Errors in Precipitation Measurements,
W79-04088 2B

REDDY, K. R.
Residual Fertilizer Nitrogen in a Flooded Rice Soil,
W79-04237 2G

The Role of Nitrate Diffusion in Determining the Order and Rate of Denitrification in Flood Soil: I. Experimental Results,
W79-04130 2G

The Role of Nitrate Diffusion in Determining the Order and Rate of Denitrification in Flooded Soil: II. Theoretical Analysis and Interpretation,
W79-04131 2G

REED, L. A.
Effectiveness of Sediment-Control Techniques used During Highway Construction in Central Pennsylvania,
W79-04403 4D

REED, R. C.
The Effects of Alum Sludge on Anaerobic Digestion,
W79-04115 5D

REETER, C. V.
Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

REEVE, R.
The Automatic Determination of ppb Levels of Ammonia, Nitrate Plus Nitrite, and Phosphate in Water in the Presence of Added Mercury (II) Chloride,
W79-04226 2K

REEVES, R. W.
Agriculture: Its Historic and Contemporary Roles in Arizona's Economy,
W79-04281 6D

REILLY, T. E.
Convective Contaminant Transport to Pumping Well,
W79-04022 5B

RENDON-HERRERO, O.
Unit Sediment Graph,
W79-04172 2J

REPLOGLE, J. A.
New Flume Breakthrough for Ditch Irrigators,
W79-04169 3F

On-Farm Level-Basin Irrigation--Save Water and Energy,
W79-04177 3F

RICHARD, M. R.
Update: What's in the Water.
W79-04242 5F

RICHARDS, R. T.
Fish Screening-The State of the Practical Art,
W79-04382 8I

RINDT, B. A.
The Effects of Alum Sludge on Primary Sedimentation and Anaerobic Digestion,
W79-04001 5D

RIORDAN, E. J.
Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part I,
W79-04109 4A

Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part II,
W79-04110 4A

RIPIN, M. J.
Bacterial Metabolism of Arylsulfonates: Role of Meta Cleavage in Benzene Sulfonate Oxidation by Pseudomonas Testosteroni,
W79-04013 5D

ROBERGE, J. C.
Minimizing Wave Transmission Through Jettied Inlets,
W79-04363 2H

ROBERTSON, P. B.
The Influence of Salinity on Toxicity of Cadmium and Chromium to the Blue Crab, Callinectes Sapidus,
W79-04319 5C

ROBINSON, W. W.
Effects of Non-Point Pollution on Benthic Invertebrates in the Lynnhaven River System,
W79-04071 5C

ROCHETTE, R.
Analysis of Practicability of a Solution to the Problem of Pollution by Spent Liquors (Analyse de practicabilite d'une solution au probleme de la pollution par les liqueurs residuelles),
W79-04400 5D

RODGERS, N.
Tensiometers Teach how to Save Fuel and Water,
W79-04165 3F

ROESKE, R. H.
Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

ROSEN, D.
Institutional Aspects of Water Resources Management at Substate Level,
W79-04309 6E

ROSENBAUM, A
Non-Point Source Pollution Studies in the Chincoteague Bay System,
W79-04488 5B

ROSOWSKI, J. R.
The Production of Mucilage by Diatoms in McConaughy, Pawnee and Yankee Hill Reservoirs and the Role of this Material in the Aquatic Environment,
W79-04310 2H

ROSS, B. B.
A Finite Element Hydrologic Model to Determine the Effect of Land Management Practices on Erosion and Sedimentation in a Watershed,
W79-04091 4D

ROSS, B. E.
A Set of Coordinated Mathematical Models for the Coastal Zone,
W79-04353 2L

ROWLAND, R. G.
Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton,
W79-04318 5C

RUGGLES, R. L.
Station Timing Selection Circuit for Irrigation Controller,
W79-04462 3F

RUSSELL, J. E.
Viability Measurements on Activated Sludge,
W79-04006 5D

SADAWARTE, N. S.
A Case for Reappraisal of Indian Water Pollution Standards as Applicable to Pulp and Paper Industry,
W79-04255 6E

SAGRAMOSO, D.
Flooding in the Desert - Nature's Paradox,
W79-04300 2A

SAMPLE, M.
Water System Design for a Low Yield Well,
W79-04250 8A

SANGER, J. E.
Fossil Pigments in Minnesota Lake Sediments and Their Bearing Upon the Balance between Terrestrial and Aquatic Inputs to Sedimentary Organic Matter,
W79-04129 2H

SASS METTO, J.
Tailoring a Pump for Farm Use,
W79-04245 4A

SASSEVILLE, D. R.
A Large-Volume Interstitial Water Sediment Squeezer for Lake Sediments,
W79-04098 2J

SASTRY, K. V.
Alteration in the Activities of Three Peptidases and Lipase in the Digestive System of the Fish Channa Punctatus Exposed to Lead Nitrate,
W79-04345 5C

In Vivo Effect of Endrin on Three Phosphatases in Kidney and Liver of the Fish Ophiocephalus Punctatus,
W79-04333 5C

SATIJA, K. S.
Flow Patterns Around Submerged Intake Structures for Power Plants,
W79-04356 8A

SAUNDERS, R. L.
Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

SAXENA, S. K.
Experimental Evaluation of Chemical Transport in Water-Saturated Porous Media: 2. Sorbing Media,
W79-04014 5A

SCAVIA, D.
A Method for Parameter Sensitivity Analysis in Differential Equation Models,
W79-04229 6A

SCHAEFER, C. H.
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

SCHICK, A. P.
Study of Sediment Generation, Transport and Deposition in Semiarid Zones,
W79-04301 2J

SCHILLER, R. E. JR.
Experimental Studies of Beach Scour Due to Wave Action,
W79-04386 2L

SCHINZINGER, R.
Water Systems and Their Emergencies,
W79-04497 6B

SCHMIDT, H. E.
Sewage Treatment System,
W79-04473 5D

SCHMIDT-HOLTHAUSEN, H. J.
Tertiary Treatment of Effluents by Filtration,
W79-04279 5D

SCHNEIDER, A. R. H.
Balancing the Interests. The Third Un-Law of the Sea Conference - (7th Session),
W79-04441 6E

SCHRALE, G.
An Acoustic Probe for Precise Determination of Deep Water Levels in Boreholes,
W79-04241 7B

SCHROEDER, W. W.
Riverine Influence on Estuaries: A Case Study,
W79-04350 2L

SCOFIELD, R. A.
Using Satellite Imagery to Detect and Estimate Rainfall from Flash-Flood Producing Thunderstorms,
W79-04072 2B

SCOTT, S.
Notes on California's Coastal Governance: A Reply to Peter Douglas,
W79-04444 6A

SEKHON, G. S.
A Rational Approach for Optimizing Application Rates of Fertilizer Nitrogen to Reduce Potential Nitrate Pollution of Natural Waters,
W79-04162 5B

SEN, Z.
A Mathematical Model of Monthly Flow Sequences,
W79-04054 2E

SEYMOUR, C. P.
Effects of Non-Point Pollution on Benthic Invertebrates in the Lynnhaven River System,
W79-04071 5C

SHABMAN, L. A.
The Effects of Inland Navigation User Charges on Barge Transportation of Wheat,
W79-04075 6C

SHAHRABANI, D.
The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

SHANE, R. M.
A Model of the Behavior of pH Determining Parameters in Impoundments,
W79-04064 5B

SHANHOLTZ, V. O.
A Finite Element Hydrologic Model to Determine the Effect of Land Management Practices on Erosion and Sedimentation in a Watershed,
W79-04091 4D

Hydrologic and Water Quality Modeling of Surface Water Discharges from Mining Operations,
W79-04134 6A

SHARMA, S. K.
In Vivo Effect of Endrin on Three Phosphatases in Kidney and Liver of the Fish Ophiocephalus Punctatus,
W79-04333 5C

SHAW, F. C.
Foraminifera, Diatom and Bivalve Distribution in Recent Sediments of the Hudson Estuary,
W79-04056 2L

SHEN, H. T.
The Effect of Ice Cover on Vertical Tranfer in Stream Channels,
W79-04062 2E

SHERMAN, B.
A Kinematic Model for Surface Irrigation,
W79-04230 2G

SHUCKROW, A. J.
Projecting Urban Runoff Flows and Loads,
W79-04050 5B

SIDDIQI, R. H.
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

SILAKOSKI, L.
Enso-Biox Method for Deodorization and Detoxification of Waste Waters,
W79-04295 5D

SILVA, H.
The Role of Streams in Pollution Dilution and Dispersion,
W79-04118 5B

SIMPSON, R. L.
Biomass and Primary Production in Freshwater Tidal Wetlands of the Middle Atlantic Coast,
W79-04485 2I

Seasonal Patterns of Nutrient Movement in a Freshwater Tidal Marsh,
W79-04484 2I

SIMS, J. L.
The Distribution of Micronutrient Cations in Soil Under Conditions of Varying Redox Potential and pH,
W79-04214 2K

SINGER, M. J.
Erosion Prediction on California Rangeland: Research Developments and Needs,
W79-04487 4D

SINGH, B.
A Rational Approach for Optimizing Application Rates of Fertilizer Nitrogen to Reduce Potential Nitrate Pollution of Natural Waters,
W79-04162 5B

SINGH, N. T.
Prediction of Phosphorus Diffusion from Fertilizer Source,
W79-04208 2K

SINGH, P.
Value of Drip Irrigation Compared with Conventional Irrigation for Vegetable Production in a Hot Arid Climate,
W79-04304 3F

Water Economy and Saline Water Use by Drip Irrigation,
W79-04303 3F

SINGH, S. D.
Effects of Planting Configuration on Water Use and Economics of Drip Irrigation Systems,
W79-04302 3F

Value of Drip Irrigation Compared with Conventional Irrigation for Vegetable Production in a Hot Arid Climate,
W79-04304 3F

Water Economy and Saline Water Use by Drip Irrigation,
W79-04303 3F

SINGH, U. P.
Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

SINGH, V. P.
A Kinematic Model for Surface Irrigation,
W79-04230 2G

SIVALINGAM, P. M.
Efficiency of Canal Biodegradation of Palm Oil Sludge and Its Pollution Effects,
W79-04332 5D

SKETCHLEY, H. R.
Erosion Prediction on California Rangeland: Research Developments and Needs,
W79-04487 4D

SKJEMSTAD, J. O.
The Automatic Determination of ppb Levels of Ammonia, Nitrate Plus Nitrite, and Phosphate in Water in the Presence of Added Mercury (II) Chloride,
W79-04226 2K

SKOGERBOE, G. V.
Effect of Irrigation Regime on Maize Yields,
W79-04174 3F

SMITH, J. D.
Water Purifying System and Pump Therefor,
W79-04460 5F

SMITH, R. L.
To Solve Highway and Farm Water Management Problems,
W79-04190 4C

SMITH, S. J.
Disposition of 15N-Labeled Fertilizer Nitrate Applied During Corn Culture in Field Lysimeters,
W79-04223 3F

Fate of Fertilizer Nitrate Applied to Coastal Bermudagrass on a Swelling Clay Soil,
W79-04215 2K

SOCHTIG, H.
Colorimetric Determination of Urea in Soil Extracts Using an Automated System,
W79-04228 2K

SONG, W. O.
Experimental Studies of Beach Scour Due to Wave Action,
W79-04386 2L

SORENSEN, E. M. B.
Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

SPAULDING, M. L.
A Three-Dimensional Numerical Model of Estuarine Circulation,
W79-04354 2L

SPEECE, R. E.
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

SPENCER, L.
Means and Method of Installing Emitters in Irrigation Tubing,
W79-04475 3F

STAAB, G. E.
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

STAMER, J. K.
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

STANDRING, K. T.
Firth of Forth Oil Pollution Incident, February 1978,
W79-04316 5B

STANFORD, H. M.
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

STARK, L. E.
Bacterial Metabolism of Arylsulfonates: Role of Meta Cleavage in Benzene Sulfonate Oxidation by Pseudomonas Testosteroni,
W79-04013 5D

STEELE, K. F.
Trace Metal Relationships in Bottom Sediments of a Fresh Water Stream--The Buffalo River, Arkansas,
W79-04017 2J

STEEN, A. J.
Extractability of 238Pu and 242Cm from a Contaminated Soil as a Function of pH and Certain Soil Components: HNO3-NaOH System,
W79-04236 2G

STEINNES, E.
Contents of Some Heavy Metals in Norwegian Rivers,
W79-04021 5A

STEVENS, D. G.
Acutely Lethal Levels of Cadmium, Copper, and Zinc to Adult Male Coho Salmon and Steelhead,
W79-04340 5C

STEVENS, S.
Green River Data Base System,
W79-04009 4A

STEWART, R. J.
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

STINEBRING, W. R.
Endotoxin in Waters of the State of Vermont,
W79-04492 5A

STOLZY, L. H.
Transient Changes in the Soil-Water System from Irrigation with Saline Water: I. Theory,
W79-04202 2G

Transient Changes in the Soil-Water System from Irrigation with Saline Water: II. Analysis of Experimental Data,
W79-04205 2G

STONE, L. R.
Irrigation Water Movement Below the Corn Root Zone in Crete Silt Loam,
W79-04483 2G

STOUT, W. L.
A New Approach to Soil Testing: III. Differential Adsorption of Potassium,
W79-04227 2K

STUMMER, F.
Electrolytic Cell for Treatment of Water,
W79-04469 5F

STUMPE, J. M.
Effects of Solution Chemistry and Environmental Conditions on Ammonia Volatilization Losses from Aqueous Systems,
W79-04180 2K

SULLIVAN, G. W.
Development and Assessment of Acute Bioassay Techniques for the Littoral Rotifer, Philodina acuticornis,
W79-04120 5A

SUNADA, D. K.
On Oscillation of Numerical Solution of a Modified Richards' Equation,
W79-04231 2G

SUNDA, W. G.
Toxicity of Cupric Ion to Eggs of the Spot Leiostomus Xanthurus and the Atlantic Silverside Menidia Menidia,
W79-04314 5C

SUNDARAM, P. N.
Hydraulic and Electro-Osmotic Permeability Coefficients,
W79-04092 2F

SUPAK, J. R.
Adsorption of Aldicarb by Clays and Soil Organo-Clay Complexes,
W79-04217 2K

SWANSON, R. L.
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

SWEENEY, A. G.
The Removal of Color from Effluent Using Various Adsorbents: Some Preliminary Economic Considerations,
W79-04253 5D

SWOBODA, A. R.
Adsorption of Aldicarb by Clays and Soil Organo-Clay Complexes,
W79-04217 2K

SZETO, C.
The Effect of Temperature on Copper Tolerance of Paramecium,
W79-04343 5C

TAFT, E. P. III
Biological and Engineering Investigation of Angled Flush Fish Diversion Screens,
W79-04383 8I

Fish Return Systems,
W79-04381 8I

TAKACS, A. P.
A Large-Volume Interstitial Water Sediment Squeezer for Lake Sediments,
W79-04098 2J

TALMI, Y.
Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

TAN, A. Y.
Mass Transfer in Nonuniform Packing,
W79-04127 8G

TANNER, R. D.
Rapid Method for Determining Numbers of Sewage Pollution Bacteria (e.g., Coliforms) in Water,
W79-04389 5A

TAO, F.
Method of Resolving a Mixture of Oil, Water, and Solids,
W79-04471 5D

Settling Tank,
W79-04474 5D

TARLOCK, A. D.
Appropriation for Instream Flow Maintenance: A Progress Report on 'New' Public Western Water Rights,
W79-04438 6E

TAYLOR, C. R.
Economically Optimum Irrigation Patterns for Grain Sorghum Production: Texas High Plains,
W79-04495 3F

TAYLOR, M. H.
Histopathological and Physiological Responses of Fundulus Heteroclitus to Napthalene Exposure,
W79-04312 5C

TENG, J. T.
Turbulent Transport to a Rotating Cylinder,
W79-04486 3A

THAVARAJ, S.
Efficiency of Canal Biodegradation of Palm Oil Sludge and Its Pollution Effects,
W79-04332 5D

THOMAS, D. J.
Spectrophotometricaly Assayed Inhibitory Effects of Mercuric Compounds on Anabaena Flos-Aquae and Anacystis Nidulans (Cyanophyceae),
W79-04327 5A

THOMPSON, A. R.
Microbial Growth on Hydrocarbons -- Some Experimental Results,
W79-04101 5A

THOMPSON, E. JR.
Section 404 of the Federal Water Pollution Control Act Amendments of 1977: Hydrologic Modification, Wetlands Protection and the Physical Integrity of the Nation's Waters,
W79-04419 5A

THOMPSON, T.
Irrigate--A Scheduling Model,
W79-04188 3F

TOEBES, G. H.
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

Green River Data Base System,
W79-04009 4A

TOTH, J.
Gravity-Induced Cross-Formational Flow of Formation Fluids, Red Earth Region, Alberta, Canada: Analysis, Patterns, and Evolution,
W79-04066 2F

TSAI, Y. J.
Intake Screenwell Surging Caused by Wave Dynamics,
W79-04357 8A

TSCHESCHKE, P.
Irrigate--A Scheduling Model,
W79-04188 3F

TUCKER, J. H.
Corporate Compliance and Compensation Problems in Environmental Protection: Implications of United States v. Reserve Mining Company,
W79-04431 5G

TUCKER, T. C.
Factors Affecting Denitrification in a Sonoran Desert Soil,
W79-04204 2K

TURNER, R. R.
Behavior and Transport of Mercury in River-Reservoir System Downstream of Inactive Chloralkali Plant,
W79-04290 5C

TYAGI, A. K.
Toxicity of Textile Waste to Some Teleost Fishes,
W79-04341 5C

TYRVAINEN, M.
Upper Layer Observations and Simulation Using Kraus and Turner's Model in the Gulf of Finland,
W79-04045 2L

UDO, E. J.
Thermodynamics of Potassium-Calcium and Magnesium-Calcium Exchange Reactions on a Kaolinitic Soil Clay,
W79-04209 2K

UEHARA, G.
Surface Charge Manipulation of Constant Surface Potential Soil Colloids: I. Relation to Sorbed Phosphorus,
W79-04203 2K

UNLUATA, U. A.
Tidal Jet Flows Near Inlets,
W79-04361 2L

URBACH, G.
Water Systems and Their Emergencies,
W79-04497 6B

URISH, D. W.
The Fresh Water Lens in a Barrier Beach,
W79-04367 2L

VARTIAK, J. F.
Aquatic Herbicides,
W79-04476 4A

VELANKAR, S. K.
Microbial Growth on Hydrocarbons -- Some Experimental Results,
W79-04101 5A

VERGE, M. J.
Three-Dimensional Modeling of Groundwater Flow Systems,
W79-04149 2F

VERMA, S. R.
Toxicity of Textile Waste to Some Teleost Fishes,
W79-04341 5C

VESANTO, A.
Enso-Biox Method for Deodorization and Detoxification of Waste Waters,
W79-04295 5D

VISOCKY, A. P.
Groundwater-Surface Water Relationship Near Lake Michigan Shore,
W79-04371 2H

VLASNIK, L. A.
Sea Water Desalinization System,
W79-04472 3A

VLEK, P. L. G.
Effects of Solution Chemistry and Environmental Conditions on Ammonia Volatilization Losses from Aqueous Systems,
W79-04180 2K

VOORHEES, J. R.
Model Studies on the Effects of Alum Sludge on the Activated Sludge Waste Treatment Process,
W79-04114 5D

WAGENET, R. J.
Multicomponent Cation Adsorption During Convective-Dispersive Flow Through Soils: Experimental Study,
W79-04218 2K

WAGNER, G. H.
Trace Metal Relationships in Bottom Sediments of a Fresh Water Stream--The Buffalo River, Arkansas,
W79-04017 2J

WALKER, P. L. JR.
Surface-Treated Activated Carbon for Removal of Ammonia from Water.
W79-04132 5D

WALKER, R.
Seasonal Patterns of Nutrient Movement in a Freshwater Tidal Marsh,
W79-04484 2I

WALSH, R. G.
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

WALTON, D. G.
The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

WANG, Y. H.
Salinity Distribution of a Highly Stratified Estuary,
W79-04364 2L

WANN, S. S.
Surface Charge Manipulation of Constant Surface Potential Soil Colloids: I. Relation to Sorbed Phosphorus,
W79-04203 2K

WARD, J. V.
Environmental Effects of Western Coal Surface Mining, Part II: The Aquatic Macroinvertebrates of Trout Creek, Colorado,
W79-04252 5C

WARD, P. J.
State Law, Not Federal, Determines Riparian Rights to Accretions,
W79-04450 6E

WARDEN, R. L. JR.
Movements of Largemouth Bass (Micropterus Salmoides) in Impounded Waters as Determined by Underwater Telemetry,
W79-04016 2H

WARNER, J. E.
Method of Resolving a Mixture of Oil, Water, and Solids,
W79-04471 5D

Settling Tank,
W79-04474 5D

WARREN, J. P.
External Costs of Land Subsidence in the Houston-Baytown Area,
W79-04015 2F

WARREN, R.
Coastal Communities - Partners or Puppets in Outer Continental Shelf Development,
W79-04426 6E

WATANABE, F. S.
Greenhouse Evaluation of Residual Phosphate by Four Phosphorus Methods in Neutral and Calcareous Soils,
W79-04178 2K

WATANABE, I.
Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

WEETER, D. W.
Assessing Nonpoint Water Quality for Small Streams,
W79-04051 5B

WEISS, D.
Foraminifera, Diatom and Bivalve Distribution in Recent Sediments of the Hudson Estuary,
W79-04056 2L

WESTERMAN, R. L.
Factors Affecting Denitrification in a Sonoran Desert Soil,
W79-04204 2K

WHIGHAM, D. F.
Biomass and Primary Production in Freshwater Tidal Wetlands of the Middle Atlantic Coast,
W79-04485 2I

Seasonal Patterns of Nutrient Movement in a Freshwater Tidal Marsh,
W79-04484 2I

WHIPPLE, W. JR.
Dual Purpose Detention Basins and Surveillance Procedures in Urbanizing Watersheds,
W79-04077 4C

Institutional Aspects of Water Resources Management at Substate Level,
W79-04309 6E

WHITE, A. W.
Salinity Effects on Growth and Toxin Content of Gonyaulax Excavata, A Marine Dinoflagellate Causing Paralytic Shellfish Poisoning,
W79-04313 5B

WHITE, D. H.
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

WHYTE, A.
Water Control and Desertification, the Resettled Nomads of Deh Luran, Iran,
W79-04306 6A

WIEDENFELD, R. P.
Effects of Evaporative Salt Water Cooling Towers on Salt Drift and Salt Deposition on Surrounding Soils,
W79-04220 5B

WILKINSON, J. W.
A Method for Parameter Sensitivity Analysis in Differential Equation Models,
W79-04229 6A

WILLIAMS, R. E.
Method of Removing Oil from Water,
W79-04479 5D

WILLIAMS, T. E.
The Use of Bounding Wells to Counteract the Effects of Gravity in Dipping Aquifers,
W79-04496 4B

WILLIAMSON, B. H.
Federal Lands and Consistency: An Intergovernmental Planning Proposal for the Coastal Zone,
W79-04446 6A

WILSON, A. W.
Technology, Regional Interdependence, and Population Growth, Tucson, Arizona,
W79-04307 6B

WILSON, T. V.
Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

WISE, J. A. JR.
The Disastrous Flood of '78,
W79-04299 2B

WITHERSPOON, P. A.
Finite Element Method for Subsurface Hydrology Using A Mixed Explicit-Implicit Scheme,
W79-04163 2F

WOLFF, A.
Who Owns Our Beaches,
W79-04418 6E

WOLLUM, A. G. II
Transport of Microorganisms in Sand Columns,
W79-04211 2I

WONG, A.
Physico-Chemical Techniques for Treating Mill Effluents: A State-of-the-Art Review,
W79-04256 5D

WOOD, I. R.
Selective Withdrawal from Two-Layer Fluid,
W79-04123 8B

WORTLEY, G. E. JR.
Aquatic Herbicides,
W79-04476 4A

WRIGHT, S. J.
Effects of Ambient Current and Density Stratification on Buoyant Jets,
W79-04387 5B

WURSTER, C. F.
Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton,
W79-04318 5C

YAKUSHIJI, T.
Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

YAO, L. S.
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

YEH, W. W-G.
A Nonlinear Programming Algorithm for Real-Time Hourly Reservoir Operations,
W79-04482 6B

YEVJEVICH, V.
Muskingum-Cunge Method with Variable Parameters,
W79-04122 2E

YOSHIDA, S.
Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

YOUNG, H. W.
Water Resources of Camas Prairie, South-Central Idaho,
W79-04031 2F

YOUNG, J. C.
Investigation of the Long-Term Effects of Chlorine on the Oxygen Demand of Wastewaters,
W79-04160 5D

YOUNG, R. A.
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

YOUNGS, E. G.
The Dependence of the Parameters in the Green and Ampt Infiltration Equation on the Initial Water Content in Draining and Wetting States,
W79-04155 2G

YOUSSEF, A.
Surface-Treated Activated Carbon for Removal of Ammonia from Water.
W79-04132 5D

YOYAMA, K.
Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

ZANKER, K.
Development of Agricultural Irrigation in the Federal Republic of Germany,
W79-04194 3F

ZAVALETA, L. R.
Economically Optimum Irrigation Patterns for Grain Sorghum Production: Texas High Plains,
W79-04495 3F

ZITKO, V.
Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

ZUBRICKI, T.
Water Sampling Bucket,
W79-04459 7B

ORGANIZATIONAL INDEX

AARHUS UNIV., (DENMARK). INST. OF GEOLOGY.
Some Errors in Precipitation Measurements,
W79-04088 2B

ABERDEEN UNIV. (SCOTLAND).
Liability for Oil Pollution Under the Merchant Shipping (Oil Pollution) Act 1971,
W79-04425 6E

AGRICULTURAL RESEARCH SERVICE, PHOENIX, AZ.
On-Farm Level-Basin Irrigation--Save Water and Energy,
W79-04177 3F

AGRICULTURAL RESEARCH SERVICE, PHOENIX, AZ. WATER CONSERVATION LAB.
Growth and Yield of Jojoba Plants in Native Stands Using Runoff-Collecting Microcatchments,
W79-04288 3F

AGRICULTURAL RESEARCH SERVICE, TEMPLE, TX. BLACKLAND CONSERVATION RESEARCH CENTER.
Fate of Fertilizer Nitrate Applied to Coastal Bermudagrass on a Swelling Clay Soil,
W79-04215 2K

ALABAMA UNIV., DAUPHIN ISLAND. MARINE SCIENCE PROGRAMS.
Riverine Influence on Estuaries: A Case Study,
W79-04350 2L

ALABAMA UNIV. IN BIRMINGHAM. DEPT. OF BIOLOGY.
Viability Measurements on Activated Sludge,
W79-04006 5D

ALBANY MEDICAL COLL., NY. DIV. OF COMPUTER SCIENCE.
A Method for Parameter Sensitivity Analysis in Differential Equation Models,
W79-04229 6A

ALBERTA RESEARCH COUNCIL, EDMONTON. GROUNDWATER DIV.
Gravity-Induced Cross-Formational Flow of Formation Fluids, Red Earth Region, Alberta, Canada: Analysis, Patterns, and Evolution,
W79-04066 2F

ALBERTA UNIV., EDMONTON. DEPT. OF SOIL SCIENCE.
Inhibition of Urease Activity by Heterocyclic Sulfur Compounds,
W79-04233 2K

AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK.
Describing Irrigation Efficiency and Uniformity,
W79-04183 3F

AMOCO PRODUCTION CO., LAFAYETTE, LA.
Productive Land Use of Dredged Material Containment Areas,
W79-04385 5E

ANIC, S.P.A., PALERMO (ITALY). (ASSIGNEE).
Method for the Purification of Sewage Waters Which Contain Organic Compounds of an Anionic Nature,
W79-04463 5D

ARIZONA AGRICULTURAL EXPERIMENT STATION, TUCSON.
Economic Analysis of the Conjunctive Use of Surface Water and Ground Water of Differing Prices and Qualities: A Coming Problem for Arizona Agriculture,
W79-04104 6B

ARIZONA SOCIETY OF PROFESSIONAL ENGINEERS, PHOENIX.
The CAP - An Engineering Marvel,
W79-04294 8A

ARIZONA STATE UNIV., TEMPE. AREA OF RECREATION IMPACT AND RESEARCH.
Report on Cibola Division (6) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04105 6B

ARIZONA STATE UNIV., TEMPE. AREA OF RECREATION IMPACT RESEARCH.
Report on Imperial Division (7) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04106 6B

Report on Laguna Division (8) of Divisional Outdoor Recreational Use and Participation Inventory of the Lower Colorado River,
W79-04107 6B

ARIZONA UNIV., TUCSON.
Technology, Regional Interdependence, and Population Growth, Tucson, Arizona,
W79-04307 6B

ARIZONA UNIV., TUCSON. DEPT. OF GEOGRAPHY.
Agriculture: Its Historic and Contemporary Roles in Arizona's Economy,
W79-04281 6D

ARIZONA UNIV., TUCSON. SCHOOL OF RENEWABLE NATURAL RESOURCES.
Action Programs for Water Yield Improvement on Arizona's Watersheds: Political Constraints to Implementation,
W79-04093 6E

ARIZONA WATER RESOURCES RESEARCH CENTER, TUCSON.
Asphalt-Crumb Rubber Waterproofing Membrane,
W79-04182 8G

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF GEOLOGY.
Trace Metal Relationships in Bottom Sediments of a Fresh Water Stream--The Buffalo River, Arkansas,
W79-04017 2J

ARMY ENGINEER DISTRICT, ALBUQUERQUE, NM.
Flood Plain Information: Sixmile Creek--Vicinity of Pueblo, Colorado.
W79-04151 2E

ARMY ENGINEER DISTRICT, GALVESTON, TX.
The Squat Phenomenon and Related Effects of Channel Geometry,
W79-04375 8B

ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
Flood Plain Information: Buxton Creek and Tributaries, Dequincy, Louisiana.
W79-04150 2E

Diffusion of Dredged Material in the Mississippi River,
W79-04384 5B

ARMY ENGINEER DISTRICT, PORTLAND, OR.
Interim Report, South Umpqua River. Volume I: Main Report.
W79-04139 4D

Interim Report, South Umpqua River. Volume II, Appendix A: Economic Data and Analysis.
W79-04140 6C

Interim Report, South Umpqua River. Volume IV, Appendices E Through J, Reports of Coordinating Agencies.
W79-04141 6G

Interim Report, South Umpqua River. Transcript of Public Meetings.
W79-04142 6B

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. ENVIRONMENTAL EFFECTS LAB.
Dredged Material Research Program, Fourth Annual Report.
W79-04044 6G

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. HYDRAULICS LAB.
Prototype Reaeration Measurements, Beltzville Dam, Pennsylvania,
W79-04380 5G

ARTHUR BROS. CO., INC., FOND DU LAC, WI.
Let's Upgrade the BOD Test,
W79-04277 5A

AUBURN UNIV., AL.
Model Studies on the Effects of Alum Sludge on the Activated Sludge Waste Treatment Process,
W79-04114 5D

The Effects of Alum Sludge on Anaerobic Digestion,
W79-04115 5D

Effects of Alum Water Treatment Sludge on Domestic Wastewater Sludges,
W79-04116 5D

AUBURN UNIV., AL. DEPT. OF CHEMICAL ENGINEERING.
Mass Transfer in Nonuniform Packing,
W79-04127 8G

AUBURN UNIV., AL. DEPT. OF SOILS.
Distribution of Arsenic in Soil Profiles After Repeated Applications of MSMA,
W79-04085 5B

AUBURN UNIVERSITY, AL. DEPT. OF CIVIL ENGINEERING.
The Effects of Alum Sludge on Primary Sedimentation and Anaerobic Digestion,
W79-04001 5D

BALLAST-NEDAM GROEP, N. V., AMSTELVEEN (NETHERLANDS).
Oil-Water Separator,
W79-04461 5G

BASIC TECHNOLOGY, INC., PITTSBURGH, PA.
Projecting Urban Runoff Flows and Loads,
W79-04050 5B

BENIN UNIV. (NIGERIA).
A Unified Approach to Watershed Modelling,
W79-04084 2A

BIG MUDDY RIVER BASIN COORDINATING COMMITTEE, IL.
Big Muddy River Comprehensive Basin Study, Illinois, Summary Report.
W79-04143 6D

BIG MUDDY RIVER COORDINATING COMMITTEE, IL.
Big Muddy River Comprehensive Basin Study, Illinois, Vol. 7, Appendix M and N.
W79-04144 6D

BRITISH COLUMBIA RESEARCH COUNCIL, VANCOUVER.
Toxicity Removed by Foam Separation,
W79-04254 5D

BUREAU OF RECLAMATION, DENVER, CO.
Spillway Stilling Basin for Low Froude Flows,
W79-04355 8B

BUREAU OF RECLAMATION, DENVER, CO. ENGINEERING AND RESEARCH CENTER.
Precipitation Management and the Environment, an Overview of the Skywater IX Conference.
W79-04157 2B

Simazine Residues in Canal Water and Crops Resulting from Experimental Application for Ditchbank Weed Control,
W79-04267 5B

Design and Analysis of Auburn Dam, Volume One: Design Data,
W79-04268 8A

Design and Analysis of Auburn Dam, Volume Two: Foundation Studies,
W79-04269 8A

Design and Analysis of Auburn Dam, Volume Three: Static Studies,
W79-04270 8A

Design and Analysis of Auburn Dam, Volume Four: Dynamic Studies,
W79-04271 8A

Design and Analysis of Auburn Dam, Volume Four Supplement: Dynamic Studies,
W79-04272 8A

Design and Analysis of Auburn Dam, Volume Four Appendices: Dynamic Studies,
W79-04273 8A

Design and Analysis of Auburn Dam, Volume Five: Summary and Conclusions,
W79-04274 8A

BURNS AND ROE CONSTRUCTION CORP., PARAMUS, NJ.
Fish Screening-The State of the Practical Art,
W79-04382 8I

CALIFORNIA INST. OF TECH., PASADENA. W. M. KECK LAB. OF HYDRAULICS AND WATER RESOURCE.
Effects of Ambient Current and Density Stratification on Buoyant Jets,
W79-04387 5B

CALIFORNIA UNIV., BERKELEY. DEPT. OF FORESTRY AND RESOURCES MANAGEMENT.
Small Mammal Habitat in Different-Aged Chamise-Wedgeleaf Ceanothus Chaparral,
W79-04259 4A

CALIFORNIA UNIV., BERKELEY. DEPT. OF MECHANICAL ENGINEERING.
Turbulent Transport to a Rotating Cylinder,
W79-04486 3A

CALIFORNIA UNIV., BERKELEY. INST. OF GOVERNMENTAL STUDIES.
Notes on California's Coastal Governance: A Reply to Peter Douglas,
W79-04444 6A

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Finite Element Method for Subsurface Hydrology Using A Mixed Explicit-Implicit Scheme,
W79-04163 2F

CALIFORNIA UNIV., BODEGA BAY. BODEGA MARINE LAB.
Acute Toxicity of the Water-Soluble Fraction of Cook Inlet Crude Oil to the Manila Clam,
W79-04323 5C

CALIFORNIA UNIV., DAVIS. DEPT. OF LAND, AIR AND WATER RESOURCES.
The Complexing and Adsorption of Cadmium in Soils in the Presence of EDTA and NTA,
W79-04007 5B

Erosion Prediction on California Rangeland: Research Developments and Needs,
W79-04487 4D

CALIFORNIA UNIV., FRESNO. MOSQUITO CONTROL RESEARCH LAB.
The Accumulation and Elimination of Diflubenzuron by Fish,
W79-04321 5C

CALIFORNIA UNIV., IRVINE. DEPT. OF ECOLOGY AND EVOLUTIONARY BIOLOGY.
Influence of Domestic Wastes on Energetic Pathways in Rocky Intertidal Communities,
W79-04133 5C

CALIFORNIA UNIV., IRVINE. SCHOOL OF ENGINEERING.
Water Systems and Their Emergencies,
W79-04497 6B

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF ENGINEERING SYSTEMS.
A Nonlinear Programming Algorithm for Real-Time Hourly Reservoir Operations,
W79-04482 6B

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF HISTORY.
Special Water Rights for Indians: Principle Versus Confusion,
W79-04121 6E

CALIFORNIA UNIV., LOS ANGELES, LAB. OF NUCLEAR MEDICINE AND RADIATION BIOLOGY.
Extractability of 238Pu and 242Cm from a Contaminated Soil as a Function of pH and Certain Soil Components: HNO3-NaOH System,
W79-04236 2G

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCE.
Transient Changes in the Soil-Water System from Irrigation with Saline Water: I. Theory,
W79-04202 2G

Transient Changes in the Soil-Water System from Irrigation with Saline Water: II. Analysis of Experimental Data,
W79-04205 2G

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL SCIENCE AND AGRICULTURAL ENGINEERING.
Denitrification in Four California Soils: Effect of Soil Profile Characteristics,
W79-04234 2G

CAMBRIDGE UNIV. (ENGLAND). DEPT. OF APPLIED BIOLOGY.
The Dependence of the Parameters in the Green and Ampt Infiltration Equation on the Initial Water Content in Draining and Wetting States,
W79-04155 2G

CAMP, DRESSER, AND MCKEE, BOSTON, MA.
Upper Trinity River Basin Comprehensive Sewerage Plan, Volume I.
W79-04135 5D

Upper Trinity River Basin Comprehensive Sewerage Plan, Volume 2: Appendix.
W79-04136 5D

CANADIAN CELLULOSE CO. LTD., PRINCE RUPERT (BRITISH COLUMBIA).
Marine Receiving Water Monitoring Program for Pulp Mill Effluent (Of Canadian Cellulose Co. Ltd.) at Prince Rupert,
W79-04416 5A

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND). DEPT. OF CIVIL ENGINEERING.
Selective Withdrawal from Two-Layer Fluid,
W79-04123 8B

CENTRA FISHERIES EXTENSION TRAINING CENTER, HYDERBAD (INDIA).
Levels of Blood Glucose and Tissue Glycogen in Two Live Fish Exposed to Industrial Effluent,
W79-04338 5A

CENTRAL ARID ZONE RESEARCH INST. JODHPUR (INDIA). DIV. OF SOIL-WATER-PLANT RELATIONSHIP STUDIES.
Effects of Planting Configuration on Water Use and Economics of Drip Irrigation Systems,
W79-04302 3F

Water Economy and Saline Water Use by Drip Irrigation,
W79-04303 3F

Value of Drip Irrigation Compared with Conventional Irrigation for Vegetable Production in a Hot Arid Climate,
W79-04304 3F

CENTRAL PULP MILLS LTD., FORT SONGAD (INDIA).
A Case for Reappraisal of Indian Water Pollution Standards as Applicable to Pulp and Paper Industry,
W79-04255 6E

CENTURY RESEARCH CORP., ARLINGTON, VA.
Social Aspects of Urban Water Conservation: A Review of the 1971-72 Field Study,
W79-04094 3D

CH2M/HILL, REDDING, CA.
Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies.
W79-04359 2L

CITY COLL., NEW YORK. DEPT. OF EARTH AND PLANETARY SCIENCES.
Foraminifera, Diatom and Bivalve Distribution in Recent Sediments of the Hudson Estuary,
W79-04056 2L

CLARK UNIV., WORCESTER, MA.
Desertification of The Great Plains: Will it Happen,
W79-04285 2A

Disintegration of a Traditional Resource-Use Complex: The Otomi of the Mezquital Valley, Hidalgo, Mexico,
W79-04293 6G

CLARKSON COLL. OF TECHNOLOGY, POTSDAM, NY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
The Effect of Ice Cover on Vertical Tranfer in Stream Channels,
W79-04062 2E

CLEMAR MFG. CORP., AZUSA, CA. (ASSIGNEE).
Station Timing Selection Circuit for Irrigation Controller,
W79-04462 3F

CLEMSON UNIV., SC. DEPT. OF AGRICULTURAL ENGINEERING.
Application of a Version of the Stanford Model to a Small Piedmont Watershed,
W79-04086 2A

Tritium Tracing of Unsaturated Moisture Movement,
W79-04266 2G

COLORADO STATE UNIV., FORT COLLINS; AND UTAH STATE UNIV., LOGAN.
Salt Pickup by Overland Flow in the Price River Basin, Utah,
W79-04298 2E

COLORADO STATE UNIV., FORT COLLINS. CENTER FOR DISEASE CONTROL.
Irrigation Management Service and Mosquito Control,
W79-04175 3F

COLORADO STATE UNIV., FORT COLLINS. CIVIL ENGR. DEPT.
Hydrologic Parameters from LANDSAT Imagery for Williams Fork Watershed,
W79-04073 5A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURE AND CHEMICAL ENGINEERING.
Effect of Irrigation Regime on Maize Yields,
W79-04174 3F

Distribution Patterns and Losses for Furrow Irrigation,
W79-04181 3F

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRONOMY.
Greenhouse Evaluation of Residual Phosphate by Four Phosphorus Methods in Neutral and Calcareous Soils,
W79-04178 2K

Development of a DTPA Soil Test for Zinc, Iron, Manganese, and Copper,
W79-04179 2K

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
A Basis for Aeration Design,
W79-04002 5D

Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part I,
W79-04109 4A

Development of a Drainage and Flood Control Management Program for Urbanizing Communities--Part II,
W79-04110 4A

Muskingum-Cunge Method with Variable Parameters,
W79-04122 2E

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF ECONOMICS.
Recreation Benefits of Water Quality: Rocky Mountain National Park, South Platte River Basin, Colorado,
W79-04004 6B

Conjunctive Ground and Surface Water Allocations: The Economics of a Quasi-Market Solution,
W79-04078 6B

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF ZOOLOGY AND ENTOMOLOGY.
Environmental Effects of Western Coal Surface Mining, Part II: The Aquatic Macroinvertebrates of Trout Creek, Colorado,
W79-04252 5C

COLORADO STATE UNIV., FT. COLLINS.
The Acute Toxicity of Copper to Gammarus Fasciatus Say, A Freshwate Amphipod,
W79-04342 5C

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, ST. LUCIA (AUSTRALIA). DIV. OF SOILS.
The Automatic Determination of ppb Levels of Ammonia, Nitrate Plus Nitrite, and Phosphate in Water in the Presence of Added Mercury (II) Chloride,
W79-04226 2K

COOK COLL., NEW BRUNSWICK, NJ. DEPT. OF ENVIRONMENTAL SCIENCE.
Distribution of Autotrophic Nitrifying Bacteria in a Polluted River (The Passaic),
W79-04070 5B

COOPERATIVE INSTREAM FLOW SERVICE GROUP, FORT COLLINS, CO.
Protecting Instream Flows Under Western Water Law: Selected Papers.
W79-04275 6E

CORNELL UNIV. AGRICULTURAL EXPERIMENT STATION, ITHACA, NY. DEPT. OF AGRONOMY.
Copper and Cadmium Adsorption Characteristics of Selected Acid and Calcareous Soils,
W79-04210 2K

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR. WESTERN FISH TOXICOLOGY STATION.
Toxicities of Cadmium, Copper, and Zinc to Four Juvenile Stages of Chinook Salmon and Steelhead,
W79-04339 5C

Acutely Lethal Levels of Cadmium, Copper, and Zinc to Adult Male Coho Salmon and Steelhead,
W79-04340 5C

COTTON RESEARCH CENTER, PHOENIX, AZ.
Importance of the Organic Phosphorus Fraction in Extracts of Calcareous Soil,
W79-04213 2K

D. A. V. COLL., MUZAFFARNAGAR (INDIA). DEPT. OF ZOOLOGY.
In Vivo Effect of Endrin on Three Phosphatases in Kidney and Liver of the Fish Ophiocephalus Punctatus,
W79-04333 5C

Alteration in the Activities of Three Peptidases and Lipase in the Digestive System of the Fish Channa Punctatus Exposed to Lead Nitrate,
W79-04345 5C

D. A. V. COLL., MUZAFFARNAGAR (INDIA). POLLUTION RELEVANT RESEARCH LAB.
Toxicity of Textile Waste to Some Teleost Fishes,
W79-04341 5C

DAR ES SALAAM UNIV. (TANZANIA).
Resettlement and Desertification: The Wagogo of Dodoma District, Tanzania,
W79-04296 6A

DELAWARE UNIV., NEWARK. COLL. OF URBAN AFFAIRS AND PUBLIC POLICY; AND DELAWARE UNIV., NEWARK. COLL. OF MARINE STUDIES.
Coastal Communities - Partners or Puppets in Outer Continental Shelf Development,
W79-04426 6E

DELAWARE UNIV., NEWARK. SCHOOL OF LIFE AND HEALTH SCIENCES.
Histopathological and Physiological Responses of Fundulus Heteroclitus to Napthalene Exposure,
W79-04312 5C

DEPARTMENT OF FISHERIES AND ENVIRONMENT, OTTAWA (ONTARIO).
The Canada Water Act Annual Report, 1977-1978.
W79-04154 6E

DEPARTMENT OF THE ENVIRONMENT, READING (ENGLAND). CENTRAL WATER PLANNING UNIT.
Identification and Separation of Major Base Flow Components from a Stream Hydrograph,
W79-04067 2E

DESERT INST., ASHKHABAD (USSR).
A Winning Battle Against Destruction,
W79-04284 3F

DREXEL UNIV., PA. ENVIRONMENTAL STUDIES INST.
The Effect of Petrochemical Structure on Methane Fermentation Toxicity,
W79-04315 5A

EDDY (AMOS), INC., NORMAN, OK.
The Effects of Rain Gage Densities on the Analysis of Storm Total Rainfall from Convective Complexes,
W79-04108 2B

EG AND G IDAHO, INC., IDAHO FALLS.
Drain-Hole Drilling Can Increase Productivity,
W79-04249 8A

ENSO-GUTZEIT OSAKEYHTIO, IMATRA (FINLAND).
Enso-Biox Method for Deodorization and Detoxification of Waste Waters,
W79-04295 5D

ENVIRONMENT PROTECTION AGENCY, DENVER, CO. REGION VIII.
South Platte River Basin Accomplishment Plan.
W79-04145 5G

ENVIRONMENTAL PROTECTION AGENCY, DENVER, CO. REGION VIII.
Accomplishment Plan, Region VIII. Comprehensive Energy-Environment Program.
W79-04137 6E

Accomplishment Plan. Region VIII. Comprehensive Energy-Environment Program. Appendix,
W79-04138 6E

ESCUELA NACIONAL DE AGRICULTURA, CHAPINGO (MEXICO)
Technology and Desertification,
W79-04283 6A

EXXON PRODUCTION RESEARCH CO., HOUSTON, TX. (ASSIGNEE).
Method of Removing Oil from Water,
W79-04479 5D

FEDERAL MINISTRY OF FOOD, AGRICULTURE AND FORESTRY, BONN (GERMANY, F.R.).
Development of Agricultural Irrigation in the Federal Republic of Germany,
W79-04194 3F

FIRMA HANS EINHELL G.M.B.H. INDUSTRIEGELANDE, LANDAU (GERMANY, F.R.). (ASSIGNEE).
Electrolytic Cell for Treatment of Water,
W79-04469 5F

FISH AND WILDLIFE SERVICE, VICTORIA, TX. GULF COAST FIELD STATION.
Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs,
W79-04317 5C

FISHERIES AND MARINE SERVICE, ST. ANDREWS (NEW BRUNSWICK). BIOLOGICAL STATION.
Salinity Effects on Growth and Toxin Content of Gonyaulax Excavata, A Marine Dinoflagellate Causing Paralytic Shellfish Poisoning,
W79-04313 5B

Effect of PCBs and Other Organochlorine Compounds on the Hatchability of Atlantic Salmon (Salmo Salar) Eggs,
W79-04320 5C

FLORIDA UNIV., GAINESVILLE. COASTAL AND OCEANOGRAPHIC ENGINEERING LAB.
Tidal Jet Flows Near Inlets,
W79-04361 2L

A Generalized Point-Velocity Method for Discharge Computations in Tidal Waterways,
W79-04378 2L

FLORIDA UNIV., GAINESVILLE. DEPT. OF COASTAL AND OCEANOGRAPHIC ENGINEERING.
Salinity Distribution of a Highly Stratified Estuary,
W79-04364 2L

FLORIDA UNIV., GAINESVILLE. DEPT. OF PLANT PATHOLOGY.
Biological Control of Water Weeds with Plant Pathogens,
W79-04311 4A

GEOLOGICAL SURVEY, ALBANY, NY. WATER RESOURCES DIV.
Quality and Movement of Ground Water in Otter Creek - Dry Creek Basin, Cortland County, New York,
W79-04035 2A

GEOLOGICAL SURVEY, ANCHORAGE, AK. WATER RESOURCES DIV.
Water Resources Data for Alaska, Water Year 1977.
W79-04032 7C

Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska,
W79-04391 2F

Channel Erosion Surveys Along the Taps Route, Alaska 1977,
W79-04411 2J

GEOLOGICAL SURVEY, BATON ROUGE, LA. WATER RESOURCES DIV.
Time of Travel of Solutes in Louisiana Streams,
W79-04401 5B

Index to Water-Resources Data for Louisiana, Ground-Water Records,
W79-04412 7C

GEOLOGICAL SURVEY, BOISE, ID. WATER RESOURCES DIV.
Water Resources of Camas Prairie, South-Central Idaho,
W79-04031 2F

GEOLOGICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.
Wyoming's Speckled Dace,
W79-04408 5A

GEOLOGICAL SURVEY, DENVER, CO. WATER RESOURCES DIV.
Trace Elements in Runoff from Rainfall and Snowmelt at Several Localities in the Denver, Colorado, Metropolitan Area,
W79-04019 5B

GEOLOGICAL SURVEY, DORAVILLE, GA. WATER RESOURCES DIV.; AND GEOLOGICAL SURVEY, DORAVILLE, GA. LAND INFORMATION ANALYSIS.
Erosion, Sediment Discharge, and Channel Morphology in the Upper Chattahoochee River Basin, Georgia,
W79-04029 2J

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.
Effectiveness of Sediment-Control Techniques used During Highway Construction in Central Pennsylvania,
W79-04403 4D

Floods of July 19-20, 1977, in the Johnstown Area, Western Pennsylvania,
W79-04413 2E

GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV.
Ground Water of the Fort Union Coal Region, Eastern Montana.
W79-04405 5B

GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV., AND GEOLOGICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.
Data for Floods of May 1978 Northeastern Wyoming and Southeastern Montana,
W79-04396 2E

GEOLOGICAL SURVEY, LAWRENCE, KS. WATER RESOURCES DIV.
Hydrologic Data for Soldier Creek Basin, Kansas,
W79-04026 7C

GEOLOGICAL SURVEY MENLO PARK, CA. WATER RESOURCES DIV.
Water Uptake by Plants: I. Divided Root Experiments,
W79-04348 2I

Water Uptake by Plants: II. The Root Contact Model,
W79-04349 2I

Potential Potable-Water Supplies in Redwood National Park,
W79-04393 6D

Water Resources Data for California, Water Year 1977--Volume 2. Pacific Slope Basins from Arroyo Grande to Oregon State Line Except Central Valley.
W79-04394 7C

Water Resources Data for California, Water Year 1977--Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.
W79-04395 7C

Water Resources Data for California, Water Year 1977--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W79-04397 7C

Water Resources Data for California, Water Year 1977--Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line.
W79-04398 7C

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV., AND GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
Geochemistry of Geopressured Geothermal Waters from the Texas Gulf Coast,
W79-04414 1A

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.; AND UNION OIL COMPANY, SANTA ROSA, CALIF.
Transient Pressure Analysis in Geothermal Steam Reservoirs with an Immobile Vaporizing Liquid Phase--Summary Report,
W79-04410 1A

GEOLOGICAL SURVEY OF ISRAEL, JERUSALEM.
Paleohydrology and Migration of the Ground-Water Divide in Regions of Tectonic Instability in Israel,
W79-04055 2F

GEOLOGICAL SURVEY, PORTLAND, OR. WATER RESOURCES DIV.
Data Needs in Urban Hydrology,
W79-04409 7A

GEOLOGICAL SURVEY, RESTON, VA.
Some Practical Techniques of Two-Dimensional Interpolation in Computational Hydraulics,
W79-04368 8B

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
Historical Profile of Quality of Water Laboratories and Activities, 1879--1973,
W79-04034 7B

Status of the National Water Data Exchange (NAWDEX)--September 1978,
W79-04392 10A

Optimization Techniques Applied to Ground-Water Development,
W79-04406 6A

GEOLOGICAL SURVEY, SAN JUAN, PR. WATER RESOURCES DIV.
Cross-Section Data for Selected Puerto Rico Streams,
W79-04390 2E

GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.
Water Resources Data for Minnesota, Water Year 1977--Volume 2. Upper Mississippi and Missouri River Basins.
W79-04023 7C

Water Resources Data for Minnesota, Water Year 1977--Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W79-04036 7C

GEOLOGICAL SURVEY, SUFFOLK, VA. WATER RESOURCES DIV.
Vegetative Communities of the Great Dismal Swamp: Identification and Mapping with Seasonal Color Infrared Photographs,
W79-04018 7B

GEOLOGICAL SURVEY, SYOSSET, NY. WATER RESOURCES DIV.
Convective Contaminant Transport to Pumping Well,
W79-04022 5B

GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Water in the Skagit River Basin, Washington,
W79-04028 7C

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Limnological Characteristics of Cypress Lake, Upper Kissimmee River Basin, Florida,
W79-04025 2H

Flood Profiles for Peace River, South-Central Florida,
W79-04027 2E

Hydrologic Evaluation of Part of Central Volusia County, Florida,
W79-04030 4B

Water Levels in Artesian and Nonartesian Aquifers of Florida, 1975-76,
W79-04404 2F

Stormwater-Runoff Data for a Highway Area, Broward County, Florida,
W79-04407 4C

GEOLOGICAL SURVEY, TOWSON, MD. WATER RESOURCES DIV.
Digital Simulation and Prediction of Water Levels in the Magothy Aquifer in Southern Maryland,
W79-04399 6A

GEOLOGICAL SURVEY, TUCSON, AZ. WATER RESOURCES DIV., AND GEOLOGICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.
Floods of September 1970 in Arizona, Utah, Colorado, and New Mexico,
W79-04402 2E

GEOLOGICAL SURVEY, UNIVERSITY, AL. WATER RESOURCES DIV.
Flood Frequency of Small Streams in Alabama,
W79-04024 6A

GEOLOGICAL SURVEY, WOODS HOLE, MA. WATER RESOURCES DIV., ALABAMA UNIV., TUSCALOOSA; AND COASTAL PETROLEUM CO., TALLAHASSEE, FL.
Hydrogeology Related to Geothermal Conditions of the Floridan Plateau,
W79-04033 2F

GEOLOGICAL SURVEY, WOODS HOLE, MA. WATER RESOURCES DIV.; NATIONAL PARK SERVICE, SAN FRANCISCO, CA.; AND GEOLOGICAL SURVEY, MIAMI, FL. WATER RESOURCES DIV.
Remote Sensing of Submarine Springs: Floridan Plateau and Jamaica, West Indies,
W79-04020 7B

GEORGIA UNIV., ATHENS. DEPT. OF FOOD SCIENCE.
Behavior of Mercury in Biosystems. III. Biotransference of Mercury Through Food Chains,
W79-04334 5B

GOTZELMANN KG INDUSTRIEABWASSER-ANLAGEN, STUTTGART (GERMANY, F.R.). (ASSIGNEE).
Method and Apparatus for Treating Metal Containing Waste Water,
W79-04478 5D

GUELPH UNIV. (ONTARIO). DEPT. OF LAND RESOURCE SCIENCE.
Potassium and Rubidium Adsorption and Diffusion in Soil,
W79-04216 2K

HANSON DRILLING CO., INC., VANCOUVER, WA.
Water System Design for a Low Yield Well,
W79-04250 8A

HAWAII UNIV., HONOLULU. DEPT. OF AGRONOMY AND SOIL SCIENCE.
Surface Charge Manipulation of Constant Surface Potential Soil Colloids: I. Relation to Sorbed Phosphorus,
W79-04203 2K

HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER.
Estimating Peak Discharges in Small Urban Hawaiian Watersheds for Selected Rainfall Frequencies, Kane'ohe Watershed, O'Ahu, Hawaii,
W79-04126 2B

HEBREW UNIV., JERUSALEM, ISRAEL.
Study of Sediment Generation, Transport and Deposition in Semiarid Zones,
W79-04301 2J

HELSINKI UNIV. (FINLAND). DEPT. OF GEOPHYSICS.
Upper Layer Observations and Simulation Using Kraus and Turner's Model in the Gulf of Finland,
W79-04045 2L

HELSKNKI UNIV. OF TECHNOLOGY, OTANIEMI (FINLAND). DEPT. OF CIVIL ENGINEERING.
A Finite Element Aquifer Model Which Takes Into Account Elevation Changes of the Aquifer,
W79-04083 2F

IBADAN UNIV. (NIGERIA) DEPT. OF AGRONOMY.
Thermodynamics of Potassium-Calcium and Magnesium-Calcium Exchange Reactions on a Kaolinitic Soil Clay,
W79-04209 2K

ICID COMMITTEE ON 'ASSEMBLING IRRIGATION EFFICIENCY DATA'.
Standards for the Calculation of Irrigation Efficiencies,
W79-04201 3F

IDAHO UNIV., MOSCOW. DEPT. OF AGRICULTURAL ENGINEERING.
Obtaining Specifications for Minimum Cost Irrigation Systems,
W79-04012 6A

ILLINOIS STATE WATER SURVEY, PEORIA. WATER QUALITY SECTION.
An Assessment of Water Quality in the Spoon River, Part 2,
W79-04047 5A

An Assessment of Water Quality in the Spoon River, Part 1,
W79-04048 5A

ILLINOIS STATE WATER SURVEY, URBANA.
Groundwater-Surface Water Relationship Near Lake Michigan Shore,
W79-04371 2H

ILLINOIS UNIV. AT THE MEDICAL CENTER, CHICAGO. DEPT. OF BIOLOGICAL SCIENCES.
The Effect of Temperature on Copper Tolerance of Paramecium,
W79-04343 5C

ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
The Additive and Interactive Effects of Powerlessness and Anomie in Predicting Opposition to Pollution Control,
W79-04010 5G

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF AGRICULTURAL ENGINEERING.
Wells and Ponds: Water Quality and Supply,
W79-04068 3C

To Solve Highway and Farm Water Management Problems,
W79-04190 4C

INDIANA UNIV., BLOOMINGTON.
Appropriation for Instream Flow Maintenance: A Progress Report on 'New' Public Western Water Rights,
W79-04438 6E

INDIANA UNIV., BLOOMINGTON. DEPT. OF GEOGRAPHY.
Topological Classifications of Drainage Networks: An Evaluation,
W79-04232 2A

INSTITUT NATIONAL DE RECHERCHE CHIMIQUE APPLIQUEE, PARIS (FRANCE).
Limiting the Costs of Pollution Control: Treatment of Effluents at the Source (Limitation du cout de la depollution: traitement des effluents a la source),
W79-04221 5D

INSTITUTT FOR ATOMENERGI, KJELLER (NORWAY). ISOTOPE LABS.
Contents of Some Heavy Metals in Norwegian Rivers,
W79-04021 5A

INTERNATIONAL FERTILIZER DEVELOPMENT CENTER, FLORENCE, AL. AGRO-ECONOMIC DIV.
Effects of Solution Chemistry and Environmental Conditions on Ammonia Volatilization Losses from Aqueous Systems,
W79-04180 2K

INTERNATIONAL INST. OF TROPICAL AGRICULTURE IBADAN (NIGERIA).
Retention and Leaching of Nutrients in a Limed Ultisol Under Cropping,
W79-04500 5B

IOWA STATE UNIV., AMES. DEPT. OF CIVIL ENGINEERING.
Investigation of the Long-Term Effects of Chlorine on the Oxygen Demand of Wastewaters,
W79-04160 5D

JOHNS HOPKINS UNIV., BALTIMORE, MD ENVIRONMENTAL HEALTH.
Relationship Between Indicator Organisms and Selected Pathogenic Bacteria in Urban Waterways,
W79-04330 5A

KANSAS STATE UNIV., MANHATTEN. DEPT. OF CHEMICAL ENGINEERING.
Transient Temperature Effects on BOD and DO Concentrations Along a Stream,
W79-04087 5G

KANSAS STATE UNIV., MANHATTEN. EVAPOTRANSPIRATION LAB.
Irrigation Water Movement Below the Corn Root Zone in Crete Silt Loam,
W79-04483 2G

KANSAS UNIV., LAWRENCE. DEPT. OF GEOLOGY.
Fortran IV Program to Compute Diversity Indices from Information Theory,
W79-04262 10D

Fortran IV Program to Compute Replicated Diversity Indices for Random Samples of Specified Size,
W79-04263 10D

Fortran IV Program to Compute Hierarchical Diversity,
W79-04264 10D

KELLY HIGH SCHOOL BEAUMONT, TX.
The Influence of Salinity on Toxicity of Cadmium and Chromium to the Blue Crab, Callinectes Sapidus,
W79-04319 5C

KENTUCKY AGRICULTURAL EXPERIMENT STATION, LEXINGTON. DEPT. OF AGRONOMY.
The Distribution of Micronutrient Cations in Soil Under Conditions of Varying Redox Potential and pH,
W79-04214 2K

KENTUCKY UNIV., LEXINGTON. DEPT. OF AGRONOMY.
The Role of Nitrate Diffusion in Determining the Order and Rate of Denitrification in Flooded Soil: II. Theoretical Analysis and Interpretation,
W79-04131 2G

KENTUCKY UNIV., LEXINGTON. DEPT. OF CIVIL ENGINEERING.
Assessing Nonpoint Water Quality for Small Streams,
W79-04051 5B

KOREAN OCEAN AND RESEARCH DEVELOPMENT INST., SEOUL (SOUTH KOREA).
Experimental Studies of Beach Scour Due to Wave Action,
W79-04386 2L

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT, CA.
Evaluation of a Barrier Against Seawater Intrusion,
W79-04370 2L

LOUISIANA STATE UNIV., BATON ROUGE.
Waste Surveillance in Subsurface Disposal Projects,
W79-04097 5E

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF PETROLEUM ENGINEERING.
The Use of Bounding Wells to Counteract the Effects of Gravity in Dipping Aquifers,
W79-04496 4B

LOUISIANA WILDLIFE AND FISHERIES COMMISSION, NEW ORLEANS.
A Study of Louisiana's Major Estuaries and Adjacent Offshore Waters,
W79-04156 2L

MACLAREN (JAMES F.) LTD., TORONTO (ONTARIO).
Wave Runup on Irregular Beach Profiles,
W79-04362 2L

MACMILLAN BLOEDEL LTD., NANIMO (BRITISH COLUMBIA).
Recent Effluent Color Reduction Trials at Alberni Pulp and Paper,
W79-04499 5D

MAINE UNIV. AT ORONO. DEPT. OF ENTOMOLOGY.
A Record of Palaeodipteron Walkeri Ide (Diptera: Nymphomyiidae) from Maine: A Species and Family New to the United States,
W79-04265 6G

MAINE UNIV. AT ORONO. DEPT. OF GEOLOGICAL SCIENCES.
A Large-Volume Interstitial Water Sediment Squeezer for Lake Sediments,
W79-04098 2J

MARYLAND UNIV., BALTIMORE. DEPT. OF GEOGRAPHY.
Reservoir Sedimentation as a Function of Precipitation Variability,
W79-04061 4D

MARYLAND UNIV., COLLEGE PARK. DEPT. OF MICROBIOLOGY.
Bacterial Metabolism of Arylsulfonates: Role of Meta Cleavage in Benzene Sulfonate Oxidation by Pseudomonas Testosteroni,
W79-04013 5D

MARYLAND UNIV., COLLEGE PARK. WATER RESOURCES RESEARCH CENTER.
Twelfth Annual Report, Program Activities, July 1, 1975-June 30, 1976.
W79-04117 10F

MARYLAND UNIV., SOLOMONS. CHESAPEAKE BIOLOGICAL LAB.
Carbon Requirements of a Population of the Estuarine Copepod Eurytemora Affinis,
W79-04011 2L

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.
Climate, Soil, and Vegetation--1. Introduction to Water Balance Dynamics,
W79-04037 2A

Climate, Soil, and Vegetation--2. The Distribution of Annual Precipitation Derived from Observed Storm Sequences,
W79-04038 2B

Climate, Soil, and Vegetation--3. A Simplified Model of Soil Moisture Movement in the Liquid Phase,
W79-04039 2G

Climate, Soil, and Vegetation--4. The Expected Value of Annual Evapotranspiration,
W79-04040 2D

Climate, Soil, and Vegetation--5. A Derived Distribution of Storm Surface Runoff,
W79-04041 2E

Climate, Soil, and Vegetation--6. Dynamics of the Annual Water Balance,
W79-04042 2A

Climate, Soil, and Vegetation--7. A Derived Distribution of Annual Water Yield,
W79-04043 2A

MASSACHUSETTS UNIV., AMHERST. WATER RESOURCES RESEARCH CENTER.
Uncertainty in Water Resource Planning in the Connecticut River Basin,
W79-04082 6B

MCDERMOTT (J. RAY) CO., INC., NEW ORLEANS, LA.
Improved Drag Force Linearizations for Structural Dynamic Calculations,
W79-04358 8B

MCGILL UNIV., MONTREAL (QUEBEC). DEPT. OF GEOLOGICAL SCIENCES.
Ground Water of the Island of Montreal, Canada,
W79-04060 2F

MEAD PAPER CO., ESCANABA, MI.
Escanaba's Environmental Systems: The First Five Years,
W79-04219 5D

MELBOURNE UNIV., PARKVILLE (AUSTRALIA). FACULTY OF AGRICULTURE AND FORESTRY.
Colorimetric Determination of Urea in Soil Extracts Using an Automated System,
W79-04228 2K

MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. DEPT. OF BIOLOGY.
The Petroleum-Inducible Mixed-Function Oxidase of Cunner (Tautogolabrus Adspersus Walbaum 1792): Some Characteristics Relevant to Hydrocarbon Monitoring,
W79-04324 5A

MINNESOTA UNIV., MINNEAPOLIS. ST. ANTHONY FALLS HYDRAULIC LAB.
Computer Programs in Water Resources,
W79-04081 7C

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE.
Movements of Largemouth Bass (Micropterus Salmoides) in Impounded Waters as Determined by Underwater Telemetry,
W79-04016 2H

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. DEPT. OF CIVIL ENGINEERING.
Unit Sediment Graph,
W79-04172 2J

MISSISSIPPI STATE UNIV. MISSISSIPPI STATE. DEPT. OF GEOLOGY AND GEOGRAPHY.
Dynamics of Wave-Induced Currents in Sediments,
W79-04076 2J

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. DEPT. OF WILDLIFE AND FISHERIES.
The Economic Impact of Increased Forest and Farmland Beaver Damage in Mississippi,
W79-04074 2H

MISSOURI UNIV.-COLUMBIA. DEPT. OF AGRONOMY.
A Neutron Activation Method for Determining Submicrogram Selenium in Forage Grasses,
W79-04235 2I

MISSOURI UNIV.- COLUMBIA. DEPT. OF CIVIL ENGINEERING.
Predicting Longitudinal Dispersion of Pollutants in Rivers,
W79-04365 5B

MONTANA FISH AND GAME DEPT., HELENA. ECOLOGICAL SERVICES DIV.
Aquatic Environmental Analysis in the Lower Yellow-Stone River,
W79-04276 6G

MONTANA STATE UNIV., BOZEMAN. DEPT. OF PLANT AND SOIL SCIENCE.
Suspended Solids Carried by the Gallatin River of Southwestern Montana: II. Using Mineralogy for Inferring Sources,
W79-04099 2J

MOSUL UNIV. (IRAQ). COLL. OF ENGINEERING.
Effect of Salinity on Agriculture in Iraq,
W79-04173 3F

NALCO CHEMICAL CO., OAK BROOK, IL. (ASSIGNEE),
Aquatic Herbicides,
W79-04476 4A

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, DC.
Simultaneous Treatment of SO2 Containing Stack Gases and Waste Water,
W79-04480 5D

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., NEW YORK.
A Study of the Fate of Suspended Solids from a Full-Scale Treatment Plant in Receiving Waters,
W79-04225 5B

NATIONAL ENVIRONMENTAL SATELLITE SERVICE, WASHINGTON, DC. APPLICATIONS DIV.
Using Satellite Imagery to Detect and Estimate Rainfall from Flash-Flood Producing Thunderstorms,
W79-04072 2B

NATIONAL MARINE FISHERIES SERVICE, BEAUFORT, NC. BEAUFORT LAB.
Toxicity of Cupric Ion to Eggs of the Spot Leiostomus Xanthurus and the Atlantic Silverside Menidia Menidia,
W79-04314 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LAB.
Turbidity Maxima in Partially Mixed Estuaries: A Two-Dimensional Numerical Model,
W79-04058 2L

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, DC. OFFICE OF SEA GRANT.
Access to the Nation's Beaches: Legal and Planning Perspectives,
W79-04448 6A

NATIONAL WATER WELL ASSOCIATION, WORTHINGTON, OH.
Artificial Recharge: Part II,
W79-04239 4B

Update: What's in the Water.
W79-04242 5F

NAVAL SEA SYSTEMS COMMAND, WASHINGTON, DC.
Progress of Protection of the Environment and Resources in the United States-A Historical Survey,
W79-04278 6E

NEBRASKA UNIV., LINCOLN. DEPT. OF AGRICULTURAL ENGINEERING.
Basic Irrigation Scheduling Procedures,
W79-04171 3F

Irrigate--A Scheduling Model,
W79-04188 3F

NEBRASKA UNIV., LINCOLN. SCHOOL OF LIFE SCIENCES.
The Production of Mucilage by Diatoms in McConaughy, Pawnee and Yankee Hill Reservoirs and the Role of this Material in the Aquatic Environment,
W79-04310 2H

NEVADA UNIV., RENO.
Finite Element Solution of Saint-Venant Equations,
W79-04100 10D

NEW HAMPSHIRE UNIV., DURHAM. WATER RESOURCES RESEARCH CENTER.
Hill Reestablishment: Retrospective Community Study of a Relocated New England Town,
W79-04158 6B

NEW JERSEY INST. OF TECH., NEWARK. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
ASCE Met Section Striving to Make Civil Engineering Curricula More Practice-Oriented,
W79-04189 9A

NEW JERSEY OYSTER RESEARCH LAB., NEW BRUNSWICK.
Swimming Speeds of Oyster Larvae Crassostrea Virginica in Different Salinities and Temperatures,
W79-04325 5A

NEW JESEY DEPT. OF ENVIRONMENTAL PROTECTION, TRENTON. DELAWARE RIVER WATER QUALITY PLANNING.
Mixing in Shallow Coastal Sea: Case Study,
W79-04049 5B

NEW MEXICO INST. OF MINING AND TECHNOLOGY, SOCORRO.
A Kinematic Model for Surface Irrigation,
W79-04230 2G

NEW MEXICO UNIV., ALBUQUERQUE. DEPT. OF BIOLOGY.
Nitrogen Inputs to Stream Water from Forests Along an Elevational Gradient in New Mexico,
W79-04498 2I

NEW ORLEANS UNIV., LA. DEPT. OF BIOLOGICAL SCIENCES.
Spectrophotometricaly Assayed Inhibitory Effects of Mercuric Compounds on Anabaena Flos-Aquae and Anacystis Nidulans (Cyanophyceae),
W79-04327 5A

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA).
Perspectives on Desertification,
W79-04282 3F

NEWCASTLE-UPON-TYNE UNIV. (GREAT BRITAIN). DEPT. OF CIVIL ENGINEERING.
Further Studies on Bifidobacteria as Indicators of Faecal Pollution in Water,
W79-04328 5A

NORTH CAROLINA STATE UNIV. AT RALEIGH.
Urban Flood Management: Problems and Research Needs,
W79-04089 4A

208 Water Quality Planning How it Will Affect You,
W79-04193 6E

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF BIOLOGICAL AND AGRICULTURAL ENGINEERING.
The Role of Nitrate Diffusion in Determining the Order and Rate of Denitrification in Flood Soil: I. Experimental Results,
W79-04130 2G

Residual Fertilizer Nitrogen in a Flooded Rice Soil,
W79-04237 2G

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF CIVIL ENGINEERING.
Comparison of Numerical Simulation Flow Models for Coastal Inlets,
W79-04352 2L

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF SOIL SCIENCE.
Transport of Microorganisms in Sand Columns,
W79-04211 2I

OAK RIDGE NATIONAL LAB., TN.
Methylated Mercury in Brook Trout (Salvelinus fontinalis): Absence of an In Vivo Methylating Process,
W79-04335 5B

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Behavior and Transport of Mercury in River-Reservoir System Downstream of Inactive Chloralkali Plant,
W79-04290 5C

OFFICE OF RADIATION PROGRAMS, LAS VEGAS, NV.
Radium-226 in Ground Water of West Central Florida,
W79-04065 5B

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRICULTURAL ENGINEERING.
Water Quality Improvement in Small Ponds,
W79-04261 5G

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRONOMY.
Factors Affecting Denitrification in a Sonoran Desert Soil,
W79-04204 2K

OKLAHOMA STATE UNIV., STILLWATER. SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING.
A Hydraulic Model Study of Propeller-Type Lake Destratification Pumps,
W79-04079 2H

OKLAHOMA UNIV., NORMAN. SCHOOL OF CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE.
The Role of Streams in Pollution Dilution and Dispersion,
W79-04118 5B

OLD DOMINION UNIV., NORFOLK, VA. DEPT. OF BIOLOGICAL SCIENCES.
Effects of Non-Point Pollution on Benthic Invertebrates in the Lynnhaven River System,
W79-04071 5C

OLSON ENGINEERING SYSTEMS, INDIO, CA.
Drip and/or Sprinkler,
W79-04192 3F

OREGON STATE UNIV., CORVALLIS. DEPT. OF FISHERIES AND WILDLIFE.
The Relative Contributions of Methylmercury from Food or Water to Rainbow Trout (Salmo gairdneri) in a Controlled Laboratory Environment,
W79-04337 5B

OREGON STATE UNIV., CORVALLIS. DEPT. OF SOIL SCIENCE.
Experimental Evaluation of Chemical Transport in Water-Saturated Porous Media: 2. Sorbing Media,
W79-04014 5A

OREGON STATE UNIV., CORVALLIS. WATER RESOURCES RESEARCH INST.
Energy and Water Resources.
W79-04112 6D

Planning for Proper Use of Land and Water.
W79-04113 6A

OSAKA PREFECTURE INST. OF PUBLIC HEALTH (JAPAN). LAB. OF FOOD CHEMISTRY.
Increase in the Human Blood PCB Levels Promptly Following Ingestion of Fish Containing PCBs,
W79-04326 5B

PANDULLO QUIRK ASSOCIATES, WAYNE, NJ.
The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey,
W79-04360 2L

PENNSYLVANIA AGRICULTURAL EXPERIMENT STATION, UNIVERSITY PARK. DEPT. OF SOIL CHEMISTRY AND WEED SCIENCE.
Atrazine Mobility in Two Soils Under Conventional Tillage,
W79-04212 2G

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRICULTURAL ENGINEERING.
Effect of Entrapped Soil Air on Infiltration,
W79-04124 2G

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRONOMY.
A New Approach to Soil Testing: III. Differential Adsorption of Potassium,
W79-04227 2K

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF CIVIL ENGINEERING.
A Model of the Behavior of pH Determining Parameters in Impoundments,
W79-04064 5B

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK, PA. DEPT. OF MATERIAL SCIENCES.
Surface-Treated Activated Carbon for Removal of Ammonia from Water.
W79-04132 5D

PPRIC, PULP AND PAPER RESEARCH INST. OF CANADA, POINTE CLAIRE (QUEBEC).
Physico-Chemical Techniques for Treating Mill Effluents: A State-of-the-Art Review,
W79-04256 5D

PRICE CO. LTD., ALMA (QUEBEC).
Experience with the Operation of an Effluent Clarifier (Experience d'operation d'un clarificateur d'effluents),
W79-04305 5D

PUNJAB AGRICULTURAL UNIV., LUDHIANA (INDIA). DEPT. OF SOILS.
A Rational Approach for Optimizing Application Rates of Fertilizer Nitrogen to Reduce Potential Nitrate Pollution of Natural Waters,
W79-04162 5B

Prediction of Phosphorus Diffusion from Fertilizer Source,
W79-04208 2K

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRICULTURAL ECONOMICS.
The Effects of Inland Navigation User Charges on Barge Transportation of Wheat,
W79-04075 6C

PURDUE UNIV., LAFAYETTE. IN. DEPT. OF AGRONOMY.
Use of K/Rb Ratio to Characterize Potassium Uptake by Plant Roots Growing in Soil,
W79-04206 2I

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF SOCIOLOGY AND ANTHROPOLOGY.
Perceptions of Effective Public Participation in Water Resources Decision Making and Their Relationship to Levels of Participation,
W79-04493 6B

PURDUE UNIV., LAFAYETTE, IN. SCHOOL OF CIVIL ENGINEERING.
Green River Basin Systems Models - Development of Six-Hour Flow Records,
W79-04008 4A

Green River Data Base System,
W79-04009 4A

QUEBEC UNIV., TROIS-RIVIERES.
Analysis of Practicability of a Solution to the Problem of Pollution by Spent Liquors (Analyse de practicabilite d'une solution au probleme de la pollution par les liqueurs residuelles),
W79-04400 5D

QUEEN'S UNIV., BELFAST (NORTHERN IRELAND). DEPT. OF INDUSTRIAL CHEMISTRY.
The Removal of Color from Effluent Using Various Adsorbents: Some Preliminary Economic Considerations,
W79-04253 5D

RADIAN CORP., AUSTIN, TX.
Determination of the Technical Potential of the Lime-Magnesium Carbonate Process, Volume I,
W79-04161 3A

RAND CORP., SANTA MONICA, CA.
The Effects of Unsteady Potential Flow on Heated Laminar Boundary Layers in Water: Flow Properties and Stability,
W79-04046 8B

RHODE ISLAND UNIV., KINGSTON. DEPT. OF CHEMICAL ENGINEERING.
Microbial Growth on Hydrocarbons -- Some Experimental Results,
W79-04101 5A

RHODE ISLAND UNIV., KINGSTON. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
The Fresh Water Lens in a Barrier Beach,
W79-04367 2L

RHODE ISLAND UNIV., KINGSTON. DEPT. OF OCEAN ENGINEERING.
A Three-Dimensional Numerical Model of Estuarine Circulation,
W79-04354 2L

RICE UNIV., HOUSTON. TX. DEPT. OF ENVIRONMENTAL SCIENCE AND ENGINEERING.
Stormwater Analysis and Prediction in Houston,
W79-04052 5B

RIDER COLL., TRENTON, NJ. DEPT. OF BIOLOGY.
Seasonal Patterns of Nutrient Movement in a Freshwater Tidal Marsh,
W79-04484 2I

Biomass and Primary Production in Freshwater Tidal Wetlands of the Middle Atlantic Coast,
W79-04485 2I

ROYAL SOCIETY FOR THE PROTECTION OF BIRDS SANDY (ENGLAND).
Firth of Forth Oil Pollution Incident, February 1978,
W79-04316 5B

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. WATER RESOURCES RESEARCH INST.
Dual Purpose Detention Basins and Surveillance Procedures in Urbanizing Watersheds,
W79-04077 4C

Institutional Aspects of Water Resources Management at Substate Level,
W79-04309 6E

SAO PAULO UNIV. (BRAZIL). DEPT. OF HYDRAULICS AND SANITARY ENGINEERING.
Nonuniform Sprinkler Irrigation Application Efficiency,
W79-04176 3F

SCHUMACHERSCHE FABRIK, BIETIGHEIM (GERMANY, F.R.).
Tertiary Treatment of Effluents by Filtration,
W79-04279 5D

SCIENCE AND EDUCATION ADMINISTRATION, KIMBERLY, ID. AGRICULTURAL ENGINEERING DIV.
Float Valves Improve Pipeline Systems,
W79-04184 3F

SCIENCE AND EDUCATION ADMINISTRATION, PHOENIX, AZ. WATER CONSERVATION LAB.
New Flume Breakthrough for Ditch Irrigators,
W79-04169 3F

SCIENCE AND EDUCATION ADMINISTRATION, TEMPLE, TX. GRASSLAND-FORAGE RESEARCH CENTER.
Disposition of 15N-Labeled Fertilizer Nitrate Applied During Corn Culture in Field Lysimeters,
W79-04223 3F

SIBIRSKII NAUCHNO-ISSLEDOVATEL'SKII INST. TSELLYULOZY I KARTONA (USSR).
Washing of Unbleached Kraft Pulp with Effluents (Promyvka sul'fatnoi nebelenoi tsellyulozy stochnymi vodami),
W79-04423 3E

SIMON-HARTLEY LTD., STOKE ON TRENT (ENGLAND).
The Filter Belt Press -- Application and Design,
W79-04286 5D

SOUTH AUSTRALIA DEPT. OF AGRICULTURE AND FISHERIES, ADELAIDE.
An Acoustic Probe for Precise Determination of Deep Water Levels in Boreholes,
W79-04241 7B

SOUTHEAST MICHIGAN COUNCIL OF GOVERNMENTS, DETROIT.
Macomb County Area of Particular Concern Inventory.
W79-04148 6G

SPESSARD L. HOLLAND LAW CENTER, GAINESVILLE, FL.
Drawing the Line at the Oceanfront: The Role of Coastal Construction Setback Lines in Regulating Development of the Coastal Zone,
W79-04432 2J

STAATLICHES INST. FUER SEENFORSCHUNG UND FISCHEREIWESEN, LANGENARGEN (GERMANY, F.R.).
Growth of Fishes During Oligo-, Meso, and Eutrophic Status of Lake Constance (Fischwachstum Bei Oligo-, Meso- und Eutrophie Des Bodensees),
W79-04336 5C

STATE UNIV. OF NEW YORK AT BUFFALO. DEPT. OF CIVIL ENGINEERING.
Diffraction of Waves by A Shore-Connected Breakwater,
W79-04377 8B

STATE UNIV. OF NEW YORK AT STONY BROOK.
June 1976 Pollution of Long Island Ocean Beaches,
W79-04053 5B

STATE UNIV. OF NEW YORK AT STONY BROOK. MARINE SCIENCES RESEARCH CENTER.
Effects of Trichloroethylene, Hexachlorobenzene and Polychlorinated Biphenyls on the Growth and Cell Size of Marine Phytoplankton,
W79-04318 5C

STATE UNIV. OF NEW YORK COLL. AT BUFFALO. GREAT LAKES LAB.
Elutriate-Primary Productivity Bioassays of Dredge Spoil Disposal in Lake Erie,
W79-04329 5B

STATE UNIV. OF NEW YORK COLL. OF ENVIRONMENTAL SCIENCE AND FORESTRY, SYRACUSE.
Earthworm Populations, Soil Bulk Density, Porosity, and Water Stable Aggregates under Effluent Application,
W79-04005 5C

STONE AND WEBSTER ENGINEERING CORP., BOSTON, MA.
Intake Screenwell Surging Caused by Wave Dynamics,
W79-04357 8A

STONE AND WEBSTER ENGINEERING CORP., BOSTON, MA. ENVIRONMENTAL ENGINEERING DIV.
Fish Return Systems,
W79-04381 8I

Biological and Engineering Investigation of Angled Flush Fish Diversion Screens,
W79-04383 8I

SULZER BRS. LTD., WINTERTHUR (SWITZERLAND). (ASSIGNEE).
Apparatus and Process for Treating Contaminated Water,
W79-04477 5D

TECHNICAL UNIV. OF DENMARK, LYNGBY. INST. OF HYDRODYNAMICS AND HYDRAULIC ENGINEERING.
Determination of Aquifer Diffusivity from Annual Fluctuations of Ground Water Levels,
W79-04069 2F

TECHNICAL UNIV. OF ISTANBUL (TURKEY).
A Mathematical Model of Monthly Flow Sequences,
W79-04054 2E

TEL-AVIV UNIV. (ISRAEL). DEPT. OF GEOPHYSICS AND PLANETARY SCIENCES; AND NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.
Earth-Atmosphere Systems and Surface Reflectivities in Arid Regions from LANDSAT MSS Data,
W79-04297 2A

TEL AVIV UNIV. (ISRAEL). SCHOOL OF ENGINEERING.
A Note on Packer, Slug, and Recovery Tests in Unconfined Aquifers,
W79-04128 2F

TEXACO INC., NEW YORK. (ASSIGNEE).
Method of Resolving a Mixture of Oil, Water, and Solids,
W79-04471 5D

Settling Tank,
W79-04474 5D

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF AGRICULTURAL ECONOMICS.
External Costs of Land Subsidence in the Houston-Baytown Area,
W79-04015 2F

Economically Optimum Irrigation Patterns for Grain Sorghum Production: Texas High Plains,
W79-04495 3F

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF CIVIL AND OCEAN ENGINEERING.
On Numerical Accuracy in Computational Hydraulics,
W79-04369 8B

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF CIVIL ENGINEERING.
Velocity Distribution and Sediment Motion Induced by Ship's Propeller in Ship Channels,
W79-04374 8B

Major Port Improvement Alternatives,
W79-04376 8B

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF SOIL AND CROP SCIENCE.
Adsorption of Aldicarb by Clays and Soil Organo-Clay Complexes,
W79-04217 2K

TEXAS A AND M UNIV., COLLEGE STATION. WATER RESOURCES INST.
A Cross-Sectional Investigation of the Determinants of Urban Residential Water Demand in the United States, 1960 and 1970,
W79-04003 6D

TEXAS AGRICULTURAL EXPERIMENT STATION, COLLEGE STATION.
Effects of Evaporative Salt Water Cooling Towers on Salt Drift and Salt Deposition on Surrounding Soils,
W79-04220 5B

TEXAS TECH UNIV., LUBBOCK.
Desertification of Arid Lands,
W79-04287 2A

TEXAS UNIV. AT AUSTIN. DEPT. OF ZOOLOGY.
Arsenic Accumulation, Tissue Distribution and Cyto-Toxicity in Teleosts Following Indirect Aqueous Exposures,
W79-04344 5C

TEXAS UNIV. HEALTH SCIENCE CENTER AT HOUSTON. SCHOOL OF PUBLIC HEALTH.
Ammonia in Texas Streams During Low Flow from Municipal Wastewater,
W79-04063 5B

Biomagnification of Heavy Metals by Organisms in a Marine Microcosm,
W79-04322 5B

THAMES WATER AUTHORITY, LONDON (ENGLAND).
Planning for Water Resources,
W79-04152 6D

THE PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRONOMY.
Responses of Several Forage and Field Crops to Subsurface Soil Warming and Sewage Effluent Spray Irrigation,
W79-04489 3F

THE PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF GEOSCIENCE.
Carbonate Hydrogeologic Environments: Their Relationship to Land Use, Water Resources Development and Management,
W79-04494 4B

THE PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF METEOROLOGY.
The Effect of Combined Soil Warming and Irrigation on the Soil Surface Energy Budget,
W79-04490 2G

THE PENNSYLVANIA STATE UNIV., UNIVERSITY PARK, PA. SCHOOL OF FOREST RESOURCES.
Soil-Warming for Waste Heat Disposal, Crop Growth Enhancement and Waste Water Renovation,
W79-04080 3C

TOKYO UNIV. (JAPAN). FACULTY OF AGRICULTURE.
Occurrence of Toxic Bivalves in Association with Gonyaulax Planktons in Ise, Owase, and Ofunato Bays,
W79-04331 5B

TORONTO UNIV. (ONTARIO).
Water Control and Desertification, the Resettled Nomads of Deh Luran, Iran,
W79-04306 6A

TROMSOE UNIV. (NORWAY). MARINE BIOLOGICAL STATION.
Rocky Bottom Fauna in a Submarine Gulley at Loppkalven, Finnmark, Northern Norway,
W79-04057 2L

TULANE UNIV., NEW ORLEANS, LA. DEPT. OF CIVIL ENGINEERING.
Modeling Dissolved Oxygen in the Near-Field,
W79-04366 5B

UNITED ENGINEERS AND CONSTRUCTORS, INC., PHILADELPHIA, PA. HYDRAULICS GROUP.
Flow Patterns Around Submerged Intake Structures for Power Plants,
W79-04356 8A

UNIVERSAL OIL PRODUCTS CO., DES PLAINES, IL. (ASSIGNEE).
Organic Waste Drying Process,
W79-04464 5D

Power Generation and Potable Water Recovery from Salinous Water,
W79-04468 3A

UNIVERSAL OIL PRODUCTS, ST. PAUL, MN. JOHNSON DIV.
Blasting-It Turns Dry Holes into Wet Ones,
W79-04251 8A

UNIVERSITI SAINS MALAYSIA, PENANG. PUSAT PENGAJIAN SAINS KAJIHAYAT.
Efficiency of Canal Biodegradation of Palm Oil Sludge and Its Pollution Effects,
W79-04332 5D

UNIVERSITY OF SOUTH FLORIDA, TAMPA. COLL. OF ENGINEERING.
A Set of Coordinated Mathematical Models for the Coastal Zone,
W79-04353 2L

UTAH AGRICULTURAL EXPERIMENT STATION, LOGAN.
A Technique for Assessing Seedling Emergence Under Drought Stress,
W79-04280 3F

UTAH INTERNATIONAL INC., SAN FRANCISCO, CA. DEPT. OF ENVIRONMENTAL QUALITY.
On Oscillation of Numerical Solution of a Modified Richards' Equation,
W79-04231 2G

UTAH STATE UNIV., LOGAN. COLL. OF NATURAL RESOURCES.
Multiple Use of Irrigation Canals,
W79-04096 6D

UTAH STATE UNIV., LOGAN. COLL. OF SCIENCE.
Life in the Great Salt Lake,
W79-04095 2H

UTAH STATE UNIV., LOGAN. DEPT. OF SOILS AND BIOMETEOROLOGY.
Multicomponent Cation Adsorption During Convective-Dispersive Flow Through Soils: Experimental Study,
W79-04218 2K

UTAH STATE UNIV., LOGAN. INST. FOR SOCIAL SCIENCE RESEARCH ON NATURAL RESOURCES.
Testing Social Indicators in the Techcom Model for Water Development,
W79-04491 6A

UTAH WATER RESEARCH LAB., LOGAN.
Dynamic Streamflow-Temperature Simulation Applied to the Brazos-Little Rivers, Texas,
W79-04379 5B

VALMONT INTERNATIONAL, VALLEY, NE.
Drainage and the Center Pivot Sprinkler Method of Irrigation,
W79-04195 3F

VALPORAISO UNIV., IN.
Land Tenure, Hazards, and the Economy: Viticulture in the Mendoza Oasis, Argentina,
W79-04291 3F

VANDERBILT UNIV., NASHVILLE, TN. DEPT. OF HYDRAULIC AND WATER RESOURCES ENGINEERING.
The Stability of a Two Layer Flow Without Shear in the Presence of Boundary Generated Turbulence: Field Verification,
W79-04372 8B

Modification of the Chezy Roughness Coefficient by Density Stratification,
W79-04373 8B

VANDERBILT UNIV., NASHVILLE, TN. SCHOOL OF ENGINEERING.
Rapid Method for Determining Numbers of Sewage Pollution Bacteria (e.g., Coliforms) in Water,
W79-04389 5A

VERMONT UNIV., BURLINGTON. DEPT. OF GEOLOGY.
Sedimentation Rates in Lake Champlain Since Settlement by Man,
W79-04308 2J

VERMONT UNIV., BURLINGTON. DEPT. OF MEDICAL MICROBIOLOGY.
Endotoxin in Waters of the State of Vermont,
W79-04492 5A

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT, VA. DEPT. OF PHYSICAL OCEANOGRAPHY AND HYDRAULICS.
Non-Point Source Pollution Studies in the Chincoteague Bay System,
W79-04488 5B

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF AGRICULTURAL ECONOMICS.
A Finite Element Hydrologic Model to Determine the Effect of Land Management Practices on Erosion and Sedimentation in a Watershed,
W79-04091 4D

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF BIOLOGY.
Development and Assessment of Acute Bioassay Techniques for the Littoral Rotifer, Philodina acuticornis,
W79-04120 5A

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.
Hydrologic and Water Quality Modeling of Surface Water Discharges from Mining Operations,
W79-04134 6A

VIRGINIA STATE WATER CONTROL BOARD, RICHMOND; AND VIRGINIA OFFICE OF EMERGENCY SERVICES, RICHMOND.
Record Floods in Southwest Virginia, April 1977.
W79-04153 2E

VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF CIVIL ENGINEERING.
Wastewater Treatment for Small Rural Communities,
W79-04119 5D

VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF ENVIRONMENTAL SCIENCES.
Transportation of Organic Detritus in Estuaries,
W79-04388 2L

VOLCANI INST. FO AGRICULTURAL RESEARCH, BET-DAGAN (ISRAEL). DIV. OF SOIL CHEMISTRY AND PLANT NUTRITION.
Phosphate Desorption from Kaolinite Suspensions,
W79-04207 2K

VOLCANI INST. OF AGRICULTURAL RESEARCH, BET-DAGAN (ISRAEL). DIV. OF SOIL CHEMISTRY AND PLANT NUTRITION.
Sodium Bicarbonate Extraction to Estimate Nitrogen, Phosphorus, and Potassium Availability in Soils,
W79-04238 2G

WAITE AGRICULTURAL RESEARCH INST., GLEN OSMOND (AUSTRALIA). DEPT. OF AGRICULTURAL BIOCHEMISTRY AND SOIL SCIENCE,
A Rainfall Simulator for Field Studies of Runoff and Soil Erosion,
W79-04289 2B

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Hydraulic Restoration of Stream Gravel for Spawning and Rearing of Salmon Species,
W79-04260 8I

WASHINGTON UNIV., SEATTLE. INST. FOR ENVIRONMENTAL STUDIES.
Electric Power Development in the Pacific Northwest Region: Institutional Commitments and Alternatives, Phase 2,
W79-04159 6E

WATERLOO UNIV. (ONTARIO).
An Iterative Quasi-Three-Dimensional Finite Element Model for Heterogeneous Multiaquifer Systems,
W79-04125 2F

WATERLOO UNIV., (ONTARIO). DEPT. OF EARTH SCIENCES.
Three-Dimensional Modeling of Groundwater Flow Systems,
W79-04149 2F

WHITE RIVER BASIN COORDINATING COMMITTEE.
Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. 1, Main Report.
W79-04146 6G

Comprehensive Basin Study: White River Basin - Arkansas and Missouri. Vol. VI: Appendix P - Plan Formulation.
W79-04147 6G

VILFRED LAURIER UNIV., WATERLOO ONTARIO).
Desertification, Development, and the 'Admirals' of Manchar Lake in Sind, Pakistan,
W79-04292 8I

VISCONSIN UNIV.-MADISON. DEPT. OF HEMISTRY.
Behavior of a Micro Flowthrough Copper Ion-Selective Electrode System in the Millimolar to Submicromolar Concentration Range,
W79-04102 1A

Application of Ion Exchange Membranes to Sampling and Enrichment: Interference of Metal Ion Binding Groups,
W79-04103 1A

VISCONSIN UNIV. MILWAUKEE. DEPT. OF IVIL ENGINEERING.
Hydraulic and Electro-Osmotic Permeability Coefficients,
W79-04092 2F

VOLLONGONG UNIV. (AUSTRALIA). DEPT. F CIVIL ENGINEERING.
A Storage-Routing Model Relating Drainage Basin Hydrology and Geomorphology,
W79-04222 2E

VOODS HOLE OCEANOGRAPHIC NSTITUTION, MA.
Mean Upwelling Velocities on the Oregon Continental Shelf During Summer 1973,
W79-04059 2L

VORCESTER POLYTECHNIC INST., OLDEN, MA. ALDEN RESEARCH LAB.
Minimizing Wave Transmission Through Jettied Inlets,
W79-04363 2H

ACCESSION NUMBER INDEX

W79-04001 5D
W79-04002 5D
W79-04003 6D
W79-04004 6B
W79-04005 5C
W79-04006 5D
W79-04007 5B
W79-04008 4A
W79-04009 4A
W79-04010 5G
W79-04011 2L
W79-04012 6A
W79-04013 5D
W79-04014 5A
W79-04015 2F
W79-04016 2H
W79-04017 2J
W79-04018 7B
W79-04019 5B
W79-04020 7B
W79-04021 5A
W79-04022 5B
W79-04023 7C
W79-04024 6A
W79-04025 2H
W79-04026 7C
W79-04027 2E
W79-04028 7C
W79-04029 2J
W79-04030 4B
W79-04031 2F
W79-04032 7C
W79-04033 2F
W79-04034 7B
W79-04035 2A
W79-04036 7C
W79-04037 2A
W79-04038 2B
W79-04039 2G
W79-04040 2D
W79-04041 2E
W79-04042 2A
W79-04043 2A
W79-04044 6G
W79-04045 2L
W79-04046 8B
W79-04047 5A
W79-04048 5A
W79-04049 5B
W79-04050 5B
W79-04051 5B
W79-04052 5B
W79-04053 5B
W79-04054 2E
W79-04055 2F
W79-04056 2L
W79-04057 2L
W79-04058 2L
W79-04059 2L
W79-04060 2F
W79-04061 4D
W79-04062 2E
W79-04063 5B
W79-04064 5B
W79-04065 5B
W79-04066 2F
W79-04067 2E
W79-04068 3C
W79-04069 2F
W79-04070 5B
W79-04071 5C
W79-04072 2B
W79-04073 5A
W79-04074 2H
W79-04075 6C
W79-04076 2J
W79-04077 4C
W79-04078 6B
W79-04079 2H
W79-04080 3C
W79-04081 7C
W79-04082 6B
W79-04083 2F
W79-04084 2A
W79-04085 5B
W79-04086 2A
W79-04087 5G
W79-04088 2B
W79-04089 4A
W79-04090 2J
W79-04091 4D
W79-04092 2F
W79-04093 6E
W79-04094 3D
W79-04095 2H
W79-04096 6D
W79-04097 5E
W79-04098 2J
W79-04099 2J
W79-04100 10D
W79-04101 5A
W79-04102 1A
W79-04103 1A
W79-04104 6B
W79-04105 6B
W79-04106 6B
W79-04107 6B
W79-04108 2B
W79-04109 4A
W79-04110 4A
W79-04111 5D
W79-04112 6D
W79-04113 6A
W79-04114 5D
W79-04115 5D
W79-04116 5D
W79-04117 10F
W79-04118 5B
W79-04119 5D
W79-04120 5A
W79-04121 6E
W79-04122 2E
W79-04123 8B
W79-04124 2G
W79-04125 2F
W79-04126 2B
W79-04127 8G
W79-04128 2F
W79-04129 2H
W79-04130 2G
W79-04131 2G
W79-04132 5D
W79-04133 5C
W79-04134 6A
W79-04135 5D
W79-04136 5D
W79-04137 6E
W79-04138 6E
W79-04139 4D
W79-04140 6C
W79-04141 6G
W79-04142 6B
W79-04143 6D
W79-04144 6D
W79-04145 5G
W79-04146 6G
W79-04147 6G
W79-04148 6G
W79-04149 2F
W79-04150 2E
W79-04151 2E
W79-04152 6D
W79-04153 2E
W79-04154 6E
W79-04155 2G
W79-04156 2L
W79-04157 2B
W79-04158 6B
W79-04159 6E
W79-04160 5D
W79-04161 3A
W79-04162 5B
W79-04163 2F
W79-04164 3F
W79-04165 3F
W79-04166 3F
W79-04167 3F
W79-04168 3F
W79-04169 3F
W79-04170 3F
W79-04171 3F
W79-04172 2J
W79-04173 3F
W79-04174 3F
W79-04175 3F
W79-04176 3F
W79-04177 3F
W79-04178 2K
W79-04179 2K
W79-04180 2K
W79-04181 3F
W79-04182 8G
W79-04183 3F
W79-04184 3F
W79-04185 8A
W79-04186 3F
W79-04187 3F
W79-04188 3F
W79-04189 9A
W79-04190 4C
W79-04191 3F
W79-04192 3F
W79-04193 6E
W79-04194 3F
W79-04195 3F
W79-04196 3F
W79-04197 6E
W79-04198 3F
W79-04199 3F
W79-04200 3F
W79-04201 3F
W79-04202 2G
W79-04203 2K
W79-04204 2K
W79-04205 2G
W79-04206 2I
W79-04207 2K
W79-04208 2K
W79-04209 2K
W79-04210 2K
W79-04211 2I
W79-04212 2G
W79-04213 2K
W79-04214 2K
W79-04215 2K
W79-04216 2K
W79-04217 2K
W79-04218 2K
W79-04219 5D
W79-04220 5B
W79-04221 5D
W79-04222 2E
W79-04223 3F
W79-04224 5D
W79-04225 5B
W79-04226 2K
W79-04227 2K
W79-04228 2K
W79-04229 6A
W79-04230 2G
W79-04231 2G
W79-04232 2A
W79-04233 2K
W79-04234 2G
W79-04235 2I
W79-04236 2G
W79-04237 2G
W79-04238 2G
W79-04239 4B
W79-04240 4B
W79-04241 7B
W79-04242 5F
W79-04243 8C
W79-04244 6D
W79-04245 4A
W79-04246 6B
W79-04247 6B
W79-04248 3C
W79-04249 8A
W79-04250 8A
W79-04251 8A
W79-04252 5C
W79-04253 5D
W79-04254 5D
W79-04255 6E
W79-04256 5D
W79-04257 1B
W79-04258 2L
W79-04259 4A
W79-04260 8I
W79-04261 5G
W79-04262 10D
W79-04263 10D
W79-04264 10D
W79-04265 6G
W79-04266 2G
W79-04267 5B
W79-04268 8A
W79-04269 8A
W79-04270 8A
W79-04271 8A
W79-04272 8A
W79-04273 8A
W79-04274 8A
W79-04275 6E
W79-04276 6G
W79-04277 5A
W79-04278 6E
W79-04279 5D
W79-04280 3F
W79-04281 6D
W79-04282 3F
W79-04283 6A
W79-04284 3F
W79-04285 2A
W79-04286 5D
W79-04287 2A
W79-04288 3F
W79-04289 2B
W79-04290 5C
W79-04291 3F
W79-04292 8I
W79-04293 6G
W79-04294 8A
W79-04295 5D
W79-04296 6A
W79-04297 2A
W79-04298 2E
W79-04299 2B
W79-04300 2A
W79-04301 2J
W79-04302 3F
W79-04303 3F
W79-04304 3F
W79-04305 5D
W79-04306 6A
W79-04307 6B
W79-04308 2J
W79-04309 6E
W79-04310 2H
W79-04311 4A
W79-04312 5C
W79-04313 5B
W79-04314 5C
W79-04315 5A
W79-04316 5B
W79-04317 5C
W79-04318 5C
W79-04319 5C
W79-04320 5C
W79-04321 5C
W79-04322 5B
W79-04323 5C
W79-04324 5A
W79-04325 5A
W79-04326 5B
W79-04327 5A
W79-04328 5A
W79-04329 5B
W79-04330 5A
W79-04331 5B
W79-04332 5D

W79-04333	5C
W79-04334	5B
W79-04335	5B
W79-04336	5C
W79-04337	5B
W79-04338	5A
W79-04339	5C
W79-04340	5C
W79-04341	5C
W79-04342	5C
W79-04343	5C
W79-04344	5C
W79-04345	5C
W79-04346	6E
W79-04347	6E
W79-04348	2I
W79-04349	2I
W79-04350	2L
W79-04351	2L
W79-04352	2L
W79-04353	2L
W79-04354	2L
W79-04355	8B
W79-04356	8A
W79-04357	8A
W79-04358	8B
W79-04359	2L
W79-04360	2L
W79-04361	2L
W79-04362	2L
W79-04363	2H
W79-04364	2L
W79-04365	5B
W79-04366	5B
W79-04367	2L
W79-04368	8B
W79-04369	8B
W79-04370	2L
W79-04371	2H
W79-04372	8B
W79-04373	8B
W79-04374	8B
W79-04375	8B
W79-04376	8B
W79-04377	8B
W79-04378	2L
W79-04379	5B
W79-04380	5G
W79-04381	8I
W79-04382	8I
W79-04383	8I
W79-04384	5B
W79-04385	5E
W79-04386	2L
W79-04387	5B
W79-04388	2L
W79-04389	5A
W79-04390	2E
W79-04391	2F
W79-04392	10A
W79-04393	6D
W79-04394	7C
W79-04395	7C
W79-04396	2E
W79-04397	7C
W79-04398	7C
W79-04399	6A
W79-04400	5D
W79-04401	5B
W79-04402	2E
W79-04403	4D
W79-04404	2F
W79-04405	5B
W79-04406	6A
W79-04407	4C
W79-04408	5A
W79-04409	7A
W79-04410	1A
W79-04411	2J
W79-04412	7C
W79-04413	2E
W79-04414	1A
W79-04415	5G
W79-04416	5A
W79-04417	6E
W79-04418	6E
W79-04419	5A
W79-04420	6E
W79-04421	5D
W79-04422	5F
W79-04423	3E
W79-04424	6E
W79-04425	6E
W79-04426	6E
W79-04427	6D
W79-04428	2H
W79-04429	2J
W79-04430	5D
W79-04431	5G
W79-04432	2J
W79-04433	5G
W79-04434	2F
W79-04435	6E
W79-04436	6E
W79-04437	6E
W79-04438	6E
W79-04439	6E
W79-04440	6E
W79-04441	6E
W79-04442	6E
W79-04443	5A
W79-04444	6A
W79-04445	6E
W79-04446	6A
W79-04447	6E
W79-04448	6A
W79-04449	6E
W79-04450	6E
W79-04451	6E
W79-04452	6E
W79-04453	6E
W79-04454	6E
W79-04455	6E
W79-04456	2F
W79-04457	6E
W79-04458	6E
W79-04459	7B
W79-04460	5F
W79-04461	5G
W79-04462	3F
W79-04463	5D
W79-04464	5D
W79-04465	5D
W79-04466	3F
W79-04467	3F
W79-04468	3A
W79-04469	5F
W79-04470	5D
W79-04471	5D
W79-04472	3A
W79-04473	5D
W79-04474	5D
W79-04475	3F
W79-04476	4A
W79-04477	5D
W79-04478	5D
W79-04479	5D
W79-04480	5D
W79-04481	5D
W79-04482	6B
W79-04483	2G
W79-04484	2I
W79-04485	2I
W79-04486	3A
W79-04487	4D
W79-04488	5B
W79-04489	3F
W79-04490	2G
W79-04491	6A
W79-04492	5A
W79-04493	6B
W79-04494	4B
W79-04495	3F
W79-04496	4B
W79-04497	6B
W79-04498	2I
W79-04499	5D
W79-04500	5B

ABSTRACT SOURCES

OURCE	ACCESSION NUMBER	TOTAL
. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W79-04130--04131 04162 04164--04171 04173--04218 04220, 04223 04226--04238 04348--04349 04500	75
DOE Oak Ridge National Laboratory, Nuclear Radiation and Safety	W79-04070	1
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W79-04256 04277--04278	3
Illinois State Water Survey, Hydrology	W79-04021 04037--04069 04072 04083--04084 04088, 04090 04092 04122--04125 04128, 04149 04155, 04163 04172, 04222 04351--04388 04498	89
Institute of Paper Chemistry, Water Pollution from Pulp and Paper Industry	W79-04219, 04221 04224--04225 04253--04255 04257--04258 04279, 04286 04290, 04295 04305, 04400 04416, 04423 04499	18

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTA
A. CENTERS OF COMPETENCE (CONTINUED)		
National Water Well Association, Water Well Construction Technology	W79-04239--04251	1
University of Arizona, Arid Land Water Resources	W79-04280--04285 04287--04289 04291--04294 04296--04304 04306--04307	2
University of Florida, Eastern U. S. Water Law	W79-04346--04347 04415 04417--04422 04424--04458	4
University of North Carolina, Metropolitan Water Resources Planning and Management	W79-04135--04148 04150--04154 04156--04158	1
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-04007--04010 04071 04073--04079 04085--04087 04089, 04091 04093 04119--04121 04126--04127 04129 04132--04134 04159--04160 04259--04261 04308--04312 04350, 04389 04483--04487 04492--04497	
C. OTHER		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-04313--04345	

ABSTRACT SOURCES

OURCE	ACCESSION NUMBER	TOTAL
. OTHER (CONTINUED)		
Information Planning Associates, Inc.	W79-04001--04006 04011--04017 04094--04118 04252 04262--04276	54
Ocean Engineering Information Service (Patents)	W79-04459--04481	23
Office of Water Research and Technology	W79-04080--04082 04161, 04482 04489--04491	8
U. S. Geological Survey	W79-04018--04020 04022--04036 04390--04399 04401--04414	42

☆U.S. GOVERNMENT PRINTING OFFICE: 1979-281-061/21

CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Illinois State Water Survey.

- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

Supported by the Environmental Protection Agency in cooperation with WRSIC

- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
- WATER RESOURCES PLANNING
- RESOURCES DATA
- ENGINEERING WORKS
- MANPOWER, GRANTS, AND FACILITIES
- SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSION NUMBER INDEX
- ABSTRACT SOURCES

U.S. MAIL

POSTAGE AND FEES PAID
U S DEPARTMENT OF COMMERCE
COM-211

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
[illegible]

PRINTED MATTER

AN EQUAL OPPORTUNITY EMPLOYER

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, U.S., and Mexico please use this price schedule; other addressees write for Folder PR-360-4.

A01	$3.00	E01	$3.01	T01	$ 16.00
A02	4.00	E02	4.75	T02	17.00
A03	4.50	E03	6.25	T03	175.00
A04	5.25	E04	7.50	T04	250.00
A05	6.00	E05	9.00	T05	300.00
A06	6.50	E06	10.50	T06	350.00
A07	7.25	E07	12.50	T07	400.00
A08	8.00	E08	14.00	T08	450.00
A09	9.00	E09	17.50	T09	500.00
A10	9.25	E10	20.00	T10	550.00
A11	9.50	E11	22.50	T11	600.00
A12	10.75	E12	25.00	T12	650.00
A13	11.00	E13	28.00	T13	675.00
A14	11.25	E14	31.00	T14	750.00
A15	12.00	E15	34.00	T15	800.00
A16	12.50	E16	37.00	T16	850.00
A17	13.00	E17	40.00	T17	900.00
A18	13.25	E18	45.00	T18	950.00
A19	14.00	E19	50.00	T19	1,000.00
A20	14.50	E20	60.00	T20	*
A21	15.00	E99	*		
A22	15.25				
A23	15.50	N01	25.00		
A24	16.25	N02	50.00		
A25	16.50				
A99	*				

*Contact NTIS for price quote

53391
S

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 10
MAY 15, 1979

W79-04501--W79-05000
CODEN:SWRABW

SELECTED WATER RESOURCES ABSTRACTS is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce, for the Water Resources Scientific Information Center (WRSIC).

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Manager, Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior, Washington, DC 20240.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is attached to the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS is also available on subscription from NTIS 5285 Port Royal Road Springfield VA 22161 Annual subscription rates for the North American Continent are SWRA Journal only $75 Journal and Annual Indexes $100 Indexes only $50 Other addressees write for prices

SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 10
MAY 15, 1979

W79-04501—W79-05000

Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion, Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use, Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants, Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes, Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning, Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand, Water Law and Institutions, Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design, Data Acquisition, Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures, Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

PUBLIC GROUNDWATER SUPPLIES IN WARREN COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-04720

OPTICS OF TURBID ESTUARINE WATERS: APPROXIMATIONS AND APPLICATIONS,
Hydroscience, Inc., Westwood, NJ.
D. M. Di Toro.
Water Research, Vol. 12, No. 12, p 1059-1068. 8 fig, 2 tab, 22 ref.

Descriptors: *Water properties, *Estuaries, *Turbidity, *Optical properties, *California, Estuarine environment, Reflectance, Suspended solids, Analytical techniques, Analysis, On-site data collections, Equations, Opacity, Chlorophyll, Measurement, Mathematical models, *San Francisco Bay Estuary.

An analysis of the radiative transfer equation was presented which is applicable for the case of angle-independent, exponentially decreasing irradiance. The results indicated that for reflectance ratios less than 10%, the extinction coefficient of downwelling irradiance is due to particle absorption and the fraction of particle scattering that is not directly forward scattered. The equations for extinction coefficient and reflectance ratio were compared to numerical solutions and other approximations. Solar angle dependence was derived from the quasi-single scattering approximation. Application of these equations to a large data set from the San Francisco Bay Estuary yielded estimates of the optical properties of the particles as functions of the concentration of non-volatile suspended solids, algal chlorophyll, and suspended detritus. The predictive value of the regression equations was tested using an independent data set. The methods developed appear to be well suited for the development of relationships between optical properties and particle characteristics and concentrations. (Humphreys-ISWS)
W79-04734

BEHAVIOR OF WATER IN VARIOUS STATES,
New Mexico Highlands Univ., Las Vegas.
J. A. Schufle, M. Venugopalan, R. Muller, and N-t Yu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-184 075, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 262, July 1967. 51 p, 19 fig, 18 tab, 15 ref. 14-01-0001-610.

Descriptors: *Capillary conductivity, *Hydrologic properties, *Movement, *Activation energy, *Water properties, Computer programs, Correlation analysis, Least squares method, Water temperature, Physical properties, Research and development.

The activation energy of conduction of water in capillaries, and the specific volume of water in capillaries were studied. In Part I, the mechanism of proton transfer in aqueous solution is discussed. Conductivity experiments were carried out using an electrometer, capillaries of Pyrex stock tubing with platinum wire electrodes, and hydrogen chloride solutions. The results obtained are tabulated; they show that activation energy in capillaries 5 microns in diameter is increased approximately 50% over that obtained in bulk solutions for 10 to the minus 4 normal hydrogen chloride solutions. The research objective of Part II was to find a precise expression for the calculation of specific volume over the temperature range of -40C to +30C, and to obtain on estimate of the temperature corresponding to minimum specific volume, based on the measurements obtained from the research reported in Part I. Water remains relatively stable at temperatures down to the range of -30C to -40C when it is retained in capillaries with diameters of 10 microns of less. A computer program was developed in an analysis of the data. Some shift in the minimum volume from the normal at 4C to near 0C was evidenced. (Davison-IPA)
W79-04951

1B. Aqueous Solutions and Suspensions

ANALYSES OF WATER, CORE MATERIAL, AND ELUTRIATE SAMPLES COLLECTED NEAR YAZOO CITY, MISSISSIPPI, (YAZOO HEADWATER PROJECT),
Geological Survey, Baton Rouge, LA. Water Resources Div.
H. L. Leone, Jr., and A. J. Dupuy.
Geological Survey open-file report 78-792, August 1978. 10 p, 1 fig, 1 plate, 4 tab, 9 ref.

Descriptors: *Water analysis, *Water quality, *Core drilling, *Bottom sediments, *Chemical analysis, Heavy metals, Pesticides, Physical properties, Sediments, Particle size, Hydrologic data, Mississippi, *Predredging study, *Yazoo Headwater Project.

Five core-material-sampling sites near Yazoo City, Miss., were chosen by the U.S. Army Corps of Engineers to represent areas of proposed dredging activity. Four receiving-water sites also were selected to represent the water that will contact the proposed dredged material. Chemical and physical analyses were performed upon core material and native-water samples from these sites as well as upon elutriate samples of specific sediment-receiving water systems. The results of these analyses are presented without interpretation. (Woodard-USGS)
W79-04793

2. WATER CYCLE

2A. General

NITRATE AND PHOSPHORUS RUNOFF LOSSES FROM SMALL WATERSHEDS IN GREAT LAKES BASIN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5C.
W79-04535

HYDROLOGIC IMPACT OF GRAZING SYSTEMS ON INFILTRATION AND RUNOFF: DEVELOPMENT OF A MODEL,
Utah State Univ., Logan. Coll. of Natural Resources.
R. H. Hawkins, and G. F. Gifford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 528, Price codes: A02 in paper copy, A01 in microfiche. Utah State University, Hydrology and Hydraulics Series UWRL/H-79/01, January 1979. 14 p, 10 fig, 8 tab, 2 append. Utah Water Research Lab. OWRT A-035-UTAH(2), 14-34-0001-8047.

Descriptors: *Hydrologic models, Infiltration, Runoff, *Grazing, Computer programs.

The response of infiltration rate (fc) to grazing systems is modeled, based on infiltration-grazing information available from past studies. As inputs the model uses a grazing system schedule, initial infiltration rate, and a characteristic recovery time. The output is a sequence of infiltration rates, from which hydrologic impact inferences may be made. Background, development, usage, cautions, and future research needs are given. A computer program of the model is supplied.
W79-04585

A NONLINEAR ANALYSIS OF THE RELATIONSHIP BETWEEN RAINFALL AND RUNOFF FOR EXTREME FLOODS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
C. C. Liu, and W. Brutsaert.
Water Resources Research, Vol. 14, No. 1, p 75-83, February 1978. 6 fig, 2 tab, 25 ref. OWRT-A-060-NY(2), 14-31-0001-5032, 14-34-0001-6033.

Descriptors: *Rainfall, *Runoff, *Floods, Floodwater, Precipitation intensity, Analytical techniques, Watersheds(Basins), Model studies, Volterra integral series, Galerkin-type method, Chebyshev polynomials.

The watershed response to heavy rainfall was considered as a hereditary process. A nonlinear system model was developed in terms of a Volterra integral series of the first kind, which satisfied the principle of dissipation of hereditary action as well as the requirement of time invariance. A workable and practical method was developed to compute optimal response or kernals of the two-term truncated Volterra series. A Galerkin-type method was used whereby the kernels were approximated by orthogonal function expansion in terms of Chebyshev polynomials.. The kernals evaluated from historical data for the Cowanesque watershed in the Chemung River basin were tested by reconstituting the hydrograph of an unrelated and unusual flood event caused by tropical storm Agnes of June 1972. It was found that the nonlinear watershed model yielded a better prediction of the hydrograph of an exceptional flood than the linear model. The performance of both nonlinear and linear models was sensitive to the assumed value of the rainfall loss rate. (Roberts-ISWS)
W79-04604

THE ARNO RIVER FLOOD STUDY (1971-1976),
Centro di Ricerca IBM di Pisa (Italy).
For primary bibliographic entry see Field 2E.
W79-04725

FACTORS AFFECTING THE EXPORT OF NITRATE-NITROGEN FROM DRAINAGE BASINS IN SOUTHERN ONTARIO,
York Univ., Toronto (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W79-04735

DRAINAGE DENSITY AND STREAMFLOW: A CLOSER LOOK,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
For primary bibliographic entry see Field 2E.
W79-04736

APPLICATION OF THE FREQUENCY-EQUIVALENT NON-LINEAR HYDROGRAPH METHOD OF FLOOD FREQUENCY ANALYSIS IN URBAN BASINS,
Kansas Water Resources Research Inst., Manhattan.
R. L. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 678, Price codes: A04 in paper copy, A01 in microfiche. Contribution No. 200, December 1978. 69 p, 21 fig, 17 ref. OWRT B-041-KAN(2), 14-34-0001-5075.

Descriptors: Urban hydrology, *Flood frequency, Unit hydrographs, *Rainfall frequency.

This project tested the application of the FENL-H methodology to urban basins. The methodology incorporates a non-linear modified rational formula approach for relating flood frequency to rainfall frequency. Specifically, the methodology utilizes the available rural data base to generate a frequency-equivalent storm and hydrograph. Transfer to urban basins is provided by assuming application of the same storm, but with adjustments of hydrograph volume in response to imperviousness and hydrograph time characteristics in response to the increase rate of rainfall excess. Forty Texas basins,

half urban and half rural, were used to test the concepts. Reasonably acceptable results were obtained in the calculations of the urban frequency curves. Attempts to reconstitute specific storm events were unsuccessful. Potential desirable changes in the methodology to overcome this difficulty are identified.
W79-04788

OPTIMAL SEQUENCE OF INCREMENTAL PRECIPITATION,
Bechtel, Inc., San Francisco, CA.
A. Prakash.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Technical Note, p. 1668-1671, December 1978. 1 tab, 5 ref, 2 append.

Descriptors: *Rainfall-runoff relationships, *Hydrographs, *Maximum probable flood, *Mathematical models, Analytical techniques, Model studies, Precipitation(Atmospheric), Unit hydrographs, Flood peak, Discharge(Water), Runoff, Hydrograph analysis, Watersheds(Basins).

The objective was to present the methodology for development of the optimal sequence of a given hyetograph that would produce maximum flood peaks for specified unit hydrograph characteristics. To illustrate the difference in the peaks of runoff hydrographs obtained with the generalized and optimal sequences, computed values for three typical cases were tabulated. For convenience, the contributions of base flow and infiltration loss were neglected. Case 1 referred to a synthetically generated 2-hr unit hydrograph with an arbitrary pattern of storm bursts characterizing heavy rainfall regions. The optimal peak in this case is 8.75% higher than the peak obtained with the generalized sequence. Case 2 presented the 4-hr unit hydrograph of the North Branch of Potomac River near Cumberland, Maryland, with a meteorologically probable storm pattern. In this case, the difference in the two peaks was 2.12%. Case 3 illustrated the sequences of effective rain for a storm lasting longer than the base of the corresponding 1-hr unit hydrograph. The 2-hr and 6-hr maximum rainfalls in this case were, respectively, 1.78 and 2.48 times the 1-hr rainfall. It was shown that, depending upon the unit hydrograph and hyetograph pattern, the peak rate of runoff given by the optimal sequence can be considerably higher than that given by the commonly used generalized sequence. (Humphreys-ISWS)
W79-04901

2B. Precipitation

SOLAR ENERGY INFORMATION AND DATA FOR ILLINOIS,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 712, Price codes: A04 in paper copy, A01 in microfiche. Circular 133, 1978. 63 p, 28 fig, 25 tab, 16 ref.

Descriptors: *Solar radiation, *Data collections, *Illinois, Radiation, Cloud cover, Seasonal, Spring, Summer, Winter, Autumn, Humidity, Air temperature, Wind velocity, Ice, Snow, Hail, Thunderstorms, *Solar energy.

This report was essentially a solar data compendium for Illinois. It contained a minimum of text and consisted mainly of tables and graphs, largely assembled from a wide variety of publications (many not easily found). It should be recognized that the designers and planners of solar energy systems will likely desire more data or some other form of solar information than that presented. Available radiation data are considered inadequate to describe the time-space variations in radiation and more measurements are needed. However, all available quality data in and around Illinois were used in the results shown, and users desiring different presentations or analyses of the data can, from this publication, be aware of where to procure available data on radiation, sunshine, temperature, and winds for different analyses. The information presented is largey based on averages for various records and periods (daily, weekly, monthly, and annually). Some extremes were presented where available. Also, where available, various probabilities of events (such as runs of days with sunshine or radiation) were given. The radiation data and information were presented first, followed by sections on sunshine and sky cover; then one on temperature, humidity, and winds; and finally one on weather hazards to solar energy systems. Selected data on basic weather factors that lead to energy demands also were presented. Average monthly values of temperatures (and extremes of temperature), relative humidity, and winds were offered for various state locales. Various weather conditions that will create problems for solar collectors were reviewed. Included were average and extreme values of hail, thunderstorms, pollution, snow, and ice, all presented to reveal the dimensions of these hazards. (Humphreys-ISWS)
W79-04719

INTERSTORM RELATIONS IN PACIFIC NORTHWEST,
National Weather Service, Silver Spring, MD. Office of Hydrology.
R. H. Frederick.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14255, p 1577-1586, December 1978. 5 fig, 3 tab, 10 ref, 1 append.

Descriptors: *Precipitation(Atmospheric), *Frequency, *Rainfall, *Washington, *Oregon, *Pacific Northwest US, Rainfall intensity, Precipitation intensity, Storms, Probability, Probable maximum precipitation, Temporal distributions, Duration curves, Design storm, Hydrology, Meteorology, Climatology, Data processing, Interstorm relations.

Annual maximum precipitation events for 1-hr, 2-hr, 3-hr, 6-hr, 12-hr, and 24-hr durations were identified. The concurrent event for each other duration was then selected. The relations between the annual maximum events and the concurrent rainfall for each other duration (which may or may not also be an annual maximum event) were studied. The interduration relations were shown to vary according to relative storm size and to be different in coastal and inland areas. A new method of developing mass precipitation curves for synthesized storms was proposed for use in hydrologic design and engineering studies. (Sims-ISWS)
W79-04733

BULK PRECIPITATION AND STREAMFLOW QUALITY RELATIONSHIPS IN AN URBAN AREA,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 2E.
W79-04738

SAMPLING AND CHEMICAL INTERPRETATION OF PRECIPITATION FOR MASS BALANCE STUDIES,
Colorado Univ., Boulder, Dept. of Environmental Population and Organismic Biology.
W. M. Lewis, Jr., and M. C. Grant.
Water Resources Research, Vol. 14, No. 6, p 1098-1104, December 1978. 2 fig, 1 tab, 53 ref.

Descriptors: *Sampling, *Precipitation(Atmospheric), *Water chemistry, *Equipment, Rainfall, Snowfall, Fallout, Chemical precipitation, Chemicals, Data collections, Chemical analysis, Bulk precipitation, Maso balance studies.

From an analytical viewpoint, total dry and wet precipitation consists of three fractions: (1) dissolved materials in aqueous precipitation, (2) the water-soluble component of dry precipitation, and (3) the water-insoluble component of either wet or dry precipitation. Methods of precipitation collection and processing greatly affect the separation of these components. A literature survey showed that fraction 3 typically has been ignored and that samplers currently in use lead to a highly variable mixture of three fractions. Major causes of interpretational ambiguity include: (1) variable leaching of dry fallout, (2) particle formation and chemical repartitioning in aqueous precipitation, (3) height, texture, and composition of the collector surfaces, (4) relation of collector surfaces to natural environmental surfaces, (5) contamination by birds, insects, pollen, and organometallic release from local vegetation, (6) sample storage, and (7) failure to analyze insoluble particles. A literature survey also showed that most collectors currently in use are of insufficient size to collect samples large enough to support broad-spectrum analysis on a weekly basis. The minimum satisfactory size of collectors was computed from: (1) average rain chemistry, (2) sensitivity of standard chemical tests for chemical species of biological interest and (3) volume required for each analysis. The computations showed that collectors should have an area of at least 1,200 sq cm in regions of average chemistry and as much as 8,300 sq cm in cold climates with minimal aqueous precipitation. A design was given for a collector which combines large size with other desirable features. (Sims-ISWS)
W79-04747

WINTER STORMS AND THE RECORD-BREAKING WINTER IN ILLINOIS,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr., and D. Changnon.
Weatherwise, Vol. 31, No. 6, p 219-225, December 1978. 4 fig, 3 tab, 4 ref.

Descriptors: *Storms, *Winter, *Snow, *Illinois, *Central U.S., Snowfall, Snow cover, Ice, Blizzards, Winds, Hazards, Distribution patterns, Precipitation(Atmospheric), Effects, Highways, Temperature, Air temperature, Climatology, Meteorology, *Winter storms, Severe winter storms, Snowstorms, Ice storms, Freezing rain.

The Midwest, including Illinois, experienced in 1977-1978 its most severe winter since weather records began in the early 19th century. The major impact in Illinois came from a record breaking number of 18 severe winter storms. In a normal year only 4 storms occur. The record winter began with three snowstorms in late November and ended with an extremely damaging ice storm in late March. Unusual snow patterns occurred with several storms and they lasted in Illinois much longer than usual. Weather conditions (low pressure centers) producing many of the storms were more often of Canadian origin than usual, and these lows had lower pressure and moved slower than normal, resulting in higher surface winds and longer lasting and hence more severe storms. Cold temperatures coupled with the frequent snowstorms resulted in record long lasting snow cover with up to 120 days with 1 inch or more cover in northern Illinois and 90 days in southern Illinois. The storms led to deaths of 62 persons and injuries to more than 2000. Utilities and communication systems suffered great losses due to damages to lines, poles, and towers. Transportation losses included damaged vehicles, delayed shipments, and great delays in bus and airline service; however, railroads benefited with increased usage and helicopters and snowmobiles proved valuable in rescue service. The local, state, and federal institutions were beset with enormous and costly problems including care of roads and lost taxable income due to absenteeism. (Sims-ISWS)
W79-04839

OPTIMAL SEQUENCE OF INCREMENTAL PRECIPITATION,
Bechtel, Inc., San Francisco, CA.
For primary bibliographic entry see Field 2A.
W79-04901

A NOTE ON THE DYNAMIC CALIBRATION OF TIPPING-BUCKET GAUGES,
Institute of Hydrology, Oxon (England).
I. R. Calder, and C. H. R. Kidd.
Journal of Hydrology, Vol. 39, No. 3/4, p. 383-386, December 1978. 2 fig, 3 ref.

Descriptors: *Calibrations, *Dynamics, *Gages, Flow, Flow rates, Precipitation(Atmospheric), Rainfall, Meteorology, Discharge, Hydrology, Rainfall intensity, *Dynamic calibration, Tipping-bucket, Flow meter, Static calibration, Non-linear relation.

This technical note was concerned with the use of tipping-bucket gages for the field measurement of flow rate or rainfall intensity. As a first approximation, a static calibration was assumed relating the flow rate to the bucket volume and the time between successive bucket tips. A non-linear relation exists between flow rate and the tipping rate of a tipping-bucket gage because a variable quantity of water, depending on the flow rate, is lost during the time taken for the bucket to move from rest to the position at which the central bucket division is beneath the inlet stream of water. It was determined that such gages should be calibrated individually for both bucket volume and the time between successive bucket tips since these parameters vary in response to changes in a number of variables, chiefly the height of the bucket stops and the resistance of the bearings. (Roberts-ISWS)
W79-04903

2C. Snow, Ice, and Frost

SOLAR ENERGY INFORMATION AND DATA FOR ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W79-04719

IS THE SOIL FROZEN OR NOT. AN ALGORITHM USING WEATHER RECORDS,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 2G.
W79-04740

SATELLITE SNOW-COVER OBSERVATIONS IN ARIZONA,
Geological Survey, Phoenix, AZ. Water Resources Div.
For primary bibliographic entry see Field 7B.
W79-04803

TIME-DEPENDENCE OF SEA-ICE CONCENTRATION AND MULTIYEAR ICE FRACTION IN THE ARCTIC BASIN,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center; and Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W79-04811

2D. Evaporation and Transpiration

MEASUREMENT OF EVAPORATION FROM LAKES AND PONDS IN FLORIDA,
Florida Univ., Gainesville. Dept. of Fruit Crops.
J. F. Bartholic, R. G. Bill, Jr., and L. H. Allen, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 561, Price codes: A05 in paper copy, A01 in microfiche. University of Florida Water Resources Research Center Publication No. 43, 1978. 81 p, 28 fig, 5 tab, 49 ref. OWRT A-031-FLA(2). 14-34-0001-8010.

Descriptors: *Evaporation, Lakes, Bowen ratio, Turbulent flux.

Hydrological models often calculate evaporation in terms of corrections to evaporation pan data. A more satisfactory approach would be to estimate evaporation rates in terms of the turbulent transport processes which govern the diffusion of water vapor in the atmospheric boundary-layer. Turbulent diffusion is evaluated through the use of (1) the Bowen ratio energy method, (2) numerical simulations of the atmosphere, (3) the eddy correlation technique, and (4) bulk transfer coefficients. Instrumentation to measure the Bowen ratio was adapted to measure latent and sensible heat fluxes from Lake Apopka. In addition to the measurement of energy fluxes from Lake Apopka, thermal imagery indicated the downwind distance for which thermal effects due to the lake were significant. These observations suggested that the atmospheric model of Gutman (1974) would adequately model the transport of energy from Lake Apopka. Direct measurements of evaporation on Orange Lake are reported. The eddy correlation technique was employed using an ultra-sonic anemometer thermometer and a Lyman-alpha humidity sensor. Results were compared with bulk transfer coefficients, as well as a new relationship by Hicks (1975) which predicts fluxes solely on the basis of surface temperature. Finally, bulk transfer coefficients are used to predict the diurnal variation in the flux of latent heat from East Lake Tohopekeliga.
W79-04583

A SIMPLIFIED MODEL OF CORN GROWTH UNDER MOISTURE STRESS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
S. W. Childs, J. R. Gilley, and W. E. Splinter.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 858-865, October 20, 1977. 7 fig, 3 tab, 21 ref. OWRT A-038-NEB(3), 14-34-0001-7058.

Descriptors: *Mathematical models, *Soil moisture, *Corn, Transpiration, Soil-plant-water relationships, Evaporation, Plant growth, Crop production, Nebraska, Water conservation, Hydraulic conductivity.

A mathematical model was developed to simulate the environmental and physiological processes involved in the growth of corn. Grain yields were accurately predicted even where inadequate irrigation caused decreased yield. Some predictions of crop growth patterns indicated that all of the dynamics of crop growth are not yet modeled in sufficient detail. However, the accuracy of growth trends in general indicate that the model has considerable predictive power. (Skogerboe-Colorado State)
W79-04607

ESTIMATING EVAPOTRANSPIRATION RATES FOR CORN IN DELAWARE,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
W. F. Ritter, T. H. Williams, and R. P. Eastburn.
Paper No. 78-2029, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 27 p, 17 fig, 1 tab, 11 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Evapotranspiration, Humid climates, *Corn, Growth stages, Consumptive use, Delaware.

The Jensen-Haise, Penman, pan evaporation and Thornthwaite methods were used to predict evapotranspiration. All methods underestimated the measured peak ET rates. The critical moisture period for corn was from the 14th leaf stage to beginning dent. (Skogerboe-Colorado State)
W79-04988

2E. Streamflow and Runoff

METHODOLOGY FOR EVALUATION OF FEASIBILITY: MULTIJURISDICTIONAL URBAN DRAINAGE AND FLOOD CONTROL PROJECTS.
Urban Drainage and Flood Control District, Denver, CO.
For primary bibliographic entry see Field 6F.
W79-04502

A NONLINEAR ANALYSIS OF THE RELATIONSHIP BETWEEN RAINFALL AND RUNOFF FOR EXTREME FLOODS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2A.
W79-04604

THE ARNO RIVER FLOOD STUDY (1971-1976),
Centro di Ricerca IBM di Pisa (Italy).
L. Panattoni, and J. R. Wallis.
EOS Transactions, American Geophysical Union, Vol. 60, No. 1, January 2, 1979. 5 p, 10 fig, 1 tab, 10 ref.

Descriptors: *Flood waves, *Flood forecasting, *Model studies, Floods, Historic floods, Flood recurrence interval, Flood routing, Storm runoff, Computer models, Foreign countries, Foreign research, *Italy, *Arno River(Italy).

The Arno River in Italy intermittently inundates large areas of the Arno River basin. This paper investigated flood phenomena and evaluated some of the proposals that have been made to alleviate the flood hazard using procedures developed at the IBM Pisa Scientific Center. The Arno River basin has an area of about 8,229 sq km with a main channel of approximately 245-km length. The completed model was tested on three of the larger historic floods that were not used for calibration of the model, the floods of 1951, 1960, and 1968. The predicted flood waves were made on the basis of the precipitation data for the events and the previously calibrated model, that is, no on-line updating of model predictions was involved. For comparison purposes, the measured flood heights and the predicted values were comparatively good for the 1951 and 1960 flood events and much less good for the 1968 event. (Humphreys-ISWS)
W79-04725

TEMPORAL MOMENTS FOR LONGITUDINAL DISPERSION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04732

DRAINAGE DENSITY AND STREAMFLOW: A CLOSER LOOK,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
S. L. Dingman.
Water Resources Research, Vol. 14, No. 6, p 1183-1187, December 1978. 2 fig, 4 tab, 25 ref.

Descriptors: *Drainage density, *Streamflow, *Thalweg, Watershed(Basins), Channels, Geomorphology, Hydrology, Groundwater, Mathematical studies, Density, Flow, *Drainage efficiency, Hortonian overland flow.

Drainage density D was defined by Horton as D = L/A, where L is the total length of stream thalwegs in an area of size A. Because the average distance from watershed divide to channel is approximately 1/2D, D often has been used as a measure of drainage efficiency and, hence, as an independent variable for predicting a wide variety of streamflow characteristics in ungaged watersheds. However, 'effective drainage density' D sub E = L sub V/A, where L sub V is the total length of stream valleys, is a better characterization of divide-to-channel distance than D. Furthermore, in Hortonian overland flow, D sub E (or approximately D) is only one of several factors affecting drainage efficiency, and its influence can be readily overridden. In saturation overland flow, neither D sub E nor D is fundamentally related to drainage efficiency, though they may proxy for more fundamental parameters. In groundwater flow, drainage efficiency is proportional to D sub E; thus higher flow variability will tend to be correlated with higher D sub E. The proportions of groundwater runoff and storm runoff from a watershed are not fundamentally related to D or D sub E, regardless of mode of flow. These theoretical conclusions were supported by close examination of previous studies relating drainage density to hydrologic variables and indicated that D sub E(or D) is of much more limited value as an independent variable for

predicting hydrologic characteristics than has been assumed in the literature. (Lee-ISWS)
W79-04736

BULK PRECIPITATION AND STREAMFLOW QUALITY RELATIONSHIPS IN AN URBAN AREA,
Tennessee Valley Authority, Knoxville.
R. P. Betson.
Water Resources Research, Vol. 14, No. 6, p 1165-1169, December 1978. 5 tab, 20 ref.

Descriptors: *Tennessee, *Water quality, *Precipitation(Atmospheric), Urban runoff, Urban hydrology, Small watersheds, Urban drainage, Streamflow, Cities, Effects, *Bulk precipitation, Streamflow water quality.

A systems study of urban hydrology was undertaken in Knoxville, Tennessee. Measurements of bulk precipitation quality were related to streamflow quality in several small watersheds. The yields of streamflow in these catchments are affected to varying degrees because they are located in carbonate terrain. Compared with bulk precipitation concentrations measured in other urban areas and in rural areas, the quality of bulk precipitation in Knoxville was found to be similar to that measured elsewhere for some 20 constituents. Input-output studies for various constituents revealed that the relationships were influenced considerably by the effect of subdrainage losses through the carbonate rock system and by urbanization. In each case, however, the atmosphere was found to provide important sources for many constituents. Comparisons of the water quality data with those from equivalent rural areas revealed the quality of these urban streams to be similar to rural streams. These findings led to the conclusion that bulk precipitation may be an important source for many constituents found in streamflow from rural and urban areas. (Lee-ISWS)
W79-04738

THE INCOMPLETE MEANS ESTIMATION PROCEDURE APPLIED TO FLOOD FREQUENCY ANALYSIS,
Massachusetts Inst. of Tech., Cambridge. Energy Lab.
J. C. Houghton.
Water Resources Research, Vol. 14, No. 6, p 1111-1115, December 1978. 2 fig, 1 tab, 6 ref, 1 append.

Descriptors: *Flood frequency, *Model studies, *Mathematical models, Floods, Flood forecasting, Damages, Mathematics, Statistics, Statistical models, Monte Carlo method, Equations, Analytical techniques, Flood flow, Hydrology, Wakeby distribution.

A new estimation procedure to predict the size of a design event, given a past flood record, was found to be superior to various alternative fitting procedures. The 'incomplete means' method uses no moments higher than the first, a procedure which results in little bias. Although the fitting procedure can be applied to any distribution, it was tested by using a variant of the Wakeby distribution. Using a small Monte Carlo experiment with a single parent distribution, the incomplete means method applied to the logs of the observations results in less regret than other fitting procedures tested. A regret model was developed which introduces a design event based on the density function as an alternative to the more traditional T-year event. (Sims-ISWS)
W79-04741

BIRTH OF A PARENT: THE WAKEBY DISTRIBUTION FOR MODELING FLOOD FLOWS,
Massachusetts Inst. of Tech., Cambridge. Energy Lab.
J. C. Houghton.
Water Resources Research, Vol. 14, No. 6, p 1105-1109, December 1978. 3 fig, 1 tab, 9 ref.

Descriptors: *Flood flow, *Flood frequency, *Model studies, Mathematical models, Floods, Flood forecasting, Distribution patterns, Mathematics, Computer models, Statistics, Hydrology, *Wakeby distribution.

Traditional distributions, such as the log normal distribution, inadequately model flood flows for certain records. The Wakeby distribution was defined to overcome this deficiency, and its analytical form proved easy to use in many applications. Tests showed that a significant number of flood records are inadequately fit by the three-parameter log normal. The Wakeby demonstrated the 'separation effect' that other distributions fail to show. Most other distributions can be mimicked by the Wakeby but not always vice versa. Thus, choosing to use the Wakeby does not limit the shape of the resulting curve to as great a degree as choosing a conventional distribution. (Sims-ISWS)
W79-04742

CHANNELIZATION AND INVERTEBRATE IN SOME IOWA STREAMS,
Iowa State Univ., Ames.
D. W. Zimmer, and R. W. Bachmann.
Water Resources Bulletin, Vol. 14, No. 4, p 868-883, August 1978. 7 fig, 3 tab, 24 ref.

Descriptors: *Streams, *Channelization, Des Moines River(Iowa), *Invertebrate drift, Aquatic insects, Water level.

Habitat diversity and invertebrate drift were studied in a group of natural and channelized tributaries of the upper Des Moines River during 1974 and 1975. Channelized streams in this region had lower sinuosity index values than natural channel segments. There were significant ($P=0.05$) positive correlations between channel sinuosity and the variability of water depth and current velocity. Invertebrate drift density, expressed as biomass and total numbers, also was correlated with channel sinuosity. Channelization has decreased habitat variability and invertebrate drift density in streams of the upper Des Moines River Basin and probably has reduced the quantity of water stored in streams during period of low flow. (Bell-Graf-Cornell)
W79-04789

FLOOD-PLAIN DELINEATION FOR HORSEPEN RUN, SUGARLAND RUN, NICHOLS RUN, AND POND BRANCH BASINS, FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
P. L. Soule.
Geological Survey open-file report 78-1028, 1978. 97 p, 59 fig, 12 tab, 4 ref.

Descriptors: *Flood profiles, *Streamflow, *Flood frequency, *Flood plains, *Flood forecasting, Flood routing, Floodways, Design flood, Flood control, Flood protection, Virginia, *Fairfax County, *Flood-plain mapping.

Water-surface profiles of the 25-, 50-, and 100-year recurrence interval discharges have been computed for all streams and reaches of channels in Fairfax County, Virginia, having a drainage area greater than 1 square mile except for Dogue Creek, Little Hunting Creek, and that portion of Cameron Run above Lake Barcroft. Maps have a 2-foot contour interval and a horizontal scale of 1 inch equals 100 feet were used for base on which flood boundaries were delineated for 25-, 50-, and 100-year floods to be expected in each basin under ultimate development conditions. This report is one of a series and presents a discussion of techniques employed in computing discharges and profiles as well as the flood profiles and maps on which flood boundaries have been delineated for the Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch basins in Fairfax County. (Woodard-USGS)
W79-04801

U.S. GEOLOGICAL SURVEY'S ROLE IN THE COLLECTION AND ANALYSIS OF PEAK-FLOW DATA ON THE ISLAND OF OAHU, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
R. Lee.
In: Proceedings of Workshop on Storm Drainage Management, Honolulu, Hawaii, January 17-18, 1978. p B1-B6, (no date).

Descriptors: *Floods, *Peak discharge, *Flood recurrence interval, *Hawaii, *Flood forecasting, Analytical techniques, Streamflow, Hydrologic data, Regression analysis, Channel morphology, Drainage area, Topography, Vegetation, Evaluation, *Island of Oahu.

With the accumulation of the peak-flow data that the Geological Survey has collected in its cooperative program with the city and county of Honolulu and the much longer program with the State of Hawaii, it is possible to evaluate the magnitudes and frequencies of future floods on Oahu. The multiple regression technique was used to relate peak discharges of various recurrence intervals to basin and climatic characteristics. Some of the basin and climatic characteristics used were drainage area, channel slope, channel length, mean basin elevation, forest cover, and mean annual precipitation. The recurrence intervals of peak flows ranged from 2 to 100 years. Many options of grouping the stations were tried. The groupings were by geographic location, elevation, size of drainage area, or a combination of these. The option which gave the best standard error of estimate in the results was one that divided the stations into five groups according to size of drainage area. (Woodard-USGS)
W79-04812

FLOOD PLAIN INFORMATION: BIG THOMPSON RIVER, WELD COUNTY, COLORADO,
Army Engineer District, Omaha, NE.
Prepared for Weld County Larimer-Weld Regional Council of Governments and Colorado Water Conservation Board, Feb. 1978. 33 p, 8 fig, 28 plates, 6 tab.

Descriptors: *Colorado, *Flooding, *Flood data, *Peak discharge, *Flood peak, *Big Thompson River(CO), *Weld County(CO), Floods, Overland flow, Indirect flood measurement, Flood forecasting, Historic floods, Flood frequency, Flood stages, Stage-discharge relations, Flood damage, Rivers, Flood plains, Non-structural alternatives, Warning systems, Land use, Control structures, 100-year flood, 500-year flood.

The study area is the Big Thompson River basin in Weld County, Colorado. This basin drains an area of about 830 square miles in North Central Colorado. The most common form of development in the flood plain within the study area is agriculture, but overall development is relatively sparce. Flood data were gathered from 2 U.S. Geological Survey gaging stations, Corps of Engineer's flood records, topographic maps, and local newspaper. Intense rainfall of cloudburst magnitude occurs in the area. Floods generally occur from May through July, but peak discharges have been recorded from March through September. No effective flood control structres have been constructed. Olympus Dam, located in the upper part of the river basin, has negligible effect in reducing flood damages. The worst recorded flood near the Drake gaging station occurred in July 1976, discharging 31,200 cubic feet per second (CFS). The Intermediate Regional Flood at the Larimer-Weld County line would discharge 10,000 CFS, while Standard Project Flood (SPF) at the same location would discharge 18,500 CFS. Downstream from Little Thompson River the SPF would discharge 20,000 CFS. This report was prepared as an aid to local officials in planning the use and regulation of the flood plain. (Coan-NC)
W79-04854

FLOOD PLAIN INFORMATION: TCHEFUNCTA RIVER AND TRIBUTARIES, COVINGTON, LA.
Army Engineer District, New Orleans, LA.
Prepared for St. Tammany Parish, November 1971. 71 p, 26 fig, 27 plates, 16 tab.

Descriptors: *Louisiana, *Flooding, *Flood data, *Flow duration, *Stage-discharge relations, *Covington(LA), *Tchefuncta River(LA), Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Historic floods, Flood recurrence interval, Flood stages, Peak discharge, Flood peak, Flow characteristics, Flood damage, Flood protection, Warning systems, Control structures, Channel improvement, Standard Project Flood, Intermediate Regional Flood, St. Tammany(LA), Bogue Falaya River(LA).

The study area includes the Tchefuncta River flood plain in the vicinity of Covington, Louisiana and the flood plains of its major tributaries, Bogue Falaya and Little Bogue Falaya Rivers. Residential developments, small farms, and businesses are scattered throughout the flood plain in the study area. Flood data were gathered from 2 stream gages, U.S. Geological Survey surveys, historical documents, and newspaper files. The only flood damage prevention measure was built in the 1880's and is a channel improvement project on the Tchefuncta and Bogue Falaya Rivers. There are no flood plain regulations presently operating in Covington. The main flood season occurs in winter and spring but intense local thunderstorms can cause flooding in the summer. Flooding occurs primarily from heavy rainfall. The greatest flood at Covington occurred in May 1953, reaching a peak discharge of 14,800 cubic feet per second (cfs). Another large flood, in November 1961, discharged 14,000 cfs at the same location. The peak discharge for the Intermediate Regional Flood on the Tchefuncta River at U.S. Highway 190 would be 22,200 cfs, with an elevation of 30.5 feet above mean sea level (msl). The Standard Project Flood would discharge 40,100 cfs with an elevation of 32.5 msl. Flood profiles are also presented for Bogue Falaya and Little Bogue Falaya Rivers. Several bridges in the study area are obstructive to flood flows. The purpose of this report is to provide a basis for further study and planning in arriving at solutions to minimize vulnerability to flood damages through possible structural and non-structural measures. (Coan-NC)
W79-04855

THE RIVER'S REACH: A UNIFIED PROGRAM FOR FLOOD PLAIN MANAGEMENT IN THE CONNECTICUT RIVER BASIN.
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 4A.
W79-04857

FLOOD HAZARD ANALYSES: WASHITA RIVER, RAINY MOUNTAIN CREEK, MOUNTAIN VIEW AND VICINITY, KIOWA COUNTY, OK.
Soil Conservation Service, Stillwater, OK.
Prepared for Town of Mountain View and Mountain View Soil Conservation District, OK, September 1977, 20 p, 8 fig, 14 plates, 19 ref, 3 appendices.

Descriptors: *Indirect flood measurement, *Historic floods, *Flood frequency, *Flood recurrence interval, *Flood plain management, *Washita River(OK), *Rainy Mountain Creek (OK), *Mountain View(OK), *Flood forecasting, *Flood profiles, Floodwater, Flooding, Regional flood, Annual flood, Streamflow forecasting, Maximum probable flood, Flood data, Flood stages, Stage-discharge relations, Rivers, Flood plains, Flood protection, Land use, Zoning, Control structures, Reservoirs, Water storage, Kiowa County(OK).

Mountain View, OK, lies near the confluence of the Washita River and Rainy Mountain Creek in northeastern Kiowa County. Most of the land use in the Rainy Mountain Creek watershed is agricultural. The study area covers 2.6 square miles. A U.S. Geological Survey stream gage is maintained on the Washita River approximately 20 miles below its confluence with Rainy Mountain Creek. Although normal discharge of the Creek is between 2,000 and 4,000 cubic feet per second (cfs), major floods with flows exceeding 10,000 cfs have occurred at three times per decade since 1921, with the most recent recorded flood in September 1965 discharging 17,400 cfs, and reaching a gage height of 23.5 ft. The largest flood occurred in May 1944, discharging 50,000 cfs, reaching a height of 26.2 ft. Estimates of floodwater surface elevation vary from 1,325.9 ft (10-year frequency) to 1,332.8 ft (500-year frequency). Events leading up to and including the 100-year occurrence would result largely in damage to crops, pastures, livestock, and some isolated farm structures. Flood plain management techniques are presented. Recommendations include updating and revising current flood prone area designations using existing Flood Hazard Boundary Maps, using zoning regulations to develop a basin master land use plan, soliciting support for current watershed flood control, and agricultural conservation measure programs. Also recommended is the establishment of a floodway area in which outdoor recreation activities are encouraged. Development of the flood fringe area should only occur if substantial floodproofing measures are taken. (Arnold-NC)
W79-04860

FLOOD PLAIN INFORMATION: CALCASIEU RIVER, OAKDALE, LOUISIANA,
Army Engineer District, New Orleans, LA.
Prepared for the City of Oakdale, LA, August 1968. 54 p, 6 fig, 19 plates, 12 tab.

Descriptors: *Louisiana, *Flooding, *Calcasieu River(LA), *Oakdale(LA), *Flood data, *Peak discharge, Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Historic floods, Flood recurrence interval, Flood stages, Flood peak, Flow duration, *Stage-discharge relations, Flood protection, Warning systems, Control structures, Levee, Glenmora(LA), Standard Project Flood, Intermediate Regional Flood.

The study area includes the city of Oakdale, Louisiana and surrounding land located in the flood plain of the Calcasieu River. The major residential developments of Oakdale are on high ground east of the Calcasieu River, but some residential and commercial development is in the flood plain. There are no discharge records of the Calcasieu River at Oakdale, but gaging stations exist in the surrounding area. Flood data were obtained from local residents, historical documents, and newspaper files. There are no existing or proposed flood control measures, nor are there any flood plain regulations in Oakdale. The main flood season is in winter and spring, and flooding results primarily from heavy rains. The highest recorded flood in the study area occurred in May 1953, reaching an elevation of 105.6 feet above mean sea level (msl) and discharging 66,200 cubic feet per second (cfs). This flood remained above bankfull stage for about 7 days. At State Highway 10 in Oakdale, the Intermediate Regional Flood is estimated to have a peak discharge of 67,100 cfs and a channel velocity of 7.1 feet per second. The Standard Project Flood would have a peak discharge of 84,900 cfs and a channel velocity of 8.1 feet per second. This report is intended to aid in the solution of local flood problems and in the best utilization of lands subject to overflow. (Coan-NC)
W79-04861

FLOOD HAZARD STUDY: BARK RIVER, VILLAGE OF DOUSMAN AND VICINITY, WAUKESHA COUNTY, WISCONSIN.
Soil Conservation Service, Madison, WI.
June, 1978. 22 p, 5 fig, 4 plates, 20 ref.

Descriptors: *Wisconsin, *Floods, *Flood plains, *Bark River(WI), *Flood protection, Flood flow, River flow, Flood frequency, Rivers, Dousman(WI), Flood plain zoning, Flood plain insurance, Building codes, Planning, Zoning, Levee, Dikes, Reservoirs, Channel improvement, 100-year flood.

This flood hazard report identifies areas subject to flooding by the Bark River in the vicinity of the town of Dousman, in Waukesha County, in the Rock River Valley of Southeastern Wisconsin. The drainage area of the Bark River above Dousman is approximately 58 square miles. The area is mainly agricultural with some urban development in incorporated areas. The watershed is generally flat and Dousman is subject to flooding by the Bark River. No major recent floods have been reported. Expected flood levels for the 100-year flood are presented at four bridge crossings. The 100-year flood is expected to reach a level of 861 feet mean sea level, with velocities ranging from 0.8 to 1.5 feet per second. Flood plain management options are suggested--planning programs and zoning and subdivision ordinances, with a list of 11 possible non-structural alternatives combined with structural flood protection works such as reservoirs, levees and dikes, pumps, channel modification and floodproofing. The report recommends purchase of flood insurance by all who live in the flood hazard area and the development of a local floodplain management program in cooperation with the Wisconsin Department of Natural Resources. (Arnold-NC)
W79-04863

SPECIAL FLOOD HAZARD INFORMATION: FRANKLIN, LOUISIANA AND VICINITY, YOKELY BAYOU AND BAYOU TECHE.
Army Engineer District, New Orleans, LA.
Prepared for City of Franklin, LA, March 1978. 25 p, 8 fig, 20 plates, 3 tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Hurricanes, *Flood data, *Franklin(LA), *Bayou Teche(LA), *Yokely Bayou(LA), Floods, Indirect flood measurement, Storms, Historic floods, Flood recurrence interval, Flood stages, Flow characteristics, Flood protection, Non-structural alternatives, Warning systems, Control structures, Levees, Locks, Channel improvement, 100-year flood.

The study area includes the city of Franklin, LA and surrounding land within the vicinity of Yokely Bayou and Bayou Teche. Both flood plains contain scattered residential and commerical development, but most of the properties are used for farming and grazing. Flood data were gathered from the National Weather Service, U. S. Geological Survey records, interviews with local residents, historical documents, and local newspaper files. The Charenton Drainage Canal was constructed after the 1927 flood. It is part of the Mississippi River and Tributaries Flood Control Project and is the major structural flood reduction measure in the study area and along with levees provides protection up to a 300-year hurricane. There are no zoning ordinances, building codes, or other regulatory measures specifically for the reduction of flood damages. Flooding along Bayou Teche and Yokely Bayou occurs primarily from hurricanes and heavy rainfall, occurring from June through October. Flood data on stage-discharge relationships do not exist for the study area. Some minor flooding occurred as a result of Hurricane Hilda in 1964, but no damaging floods have occurred since the 1927 flood. No records of discharge are available for that flood. The most serious flood threat in the future is from hurricane surges overtopping the protective levees west and south of Franklin. This report furnishes a suitable basis for the adoption of land use controls to guide flood plain development. (Coan-NC)
W79-04864

FLOOD PLAIN INFORMATION: SALT CREEK - VICINITY OF PUEBLO, COLORADO.
Army Engineer District, Albuquerque, NM.
Prepared for City and County of Pueblo, CO., April 1976. 30 p, 4 fig, 21 plates, 4 tab.

Descriptors: *Colorado, *Flooding, *Flood protection, Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Flood stages, Peak discharge, Flood peak, Stage-discharge relations, Rivers, Floodways, Standard Project Flood, Non-structural alternatives, Warning systems, Building codes, Land use, Planning, Control structures, Floodproofing, *Flood plain zoning, *Zoning, *Salt Creek(CO), *Pueblo(CO), *Flood plain management, Intermediate Regional Flood.

Salt Creek is a right bank tributary to the Arkansas River, with its confluence being located in the

southeast corner of the city of Pueblo, Colorado. The Salt Creek watershed is a flood prone area, containing 37.2 square miles. The creek flows through the residential and major industrial areas of southeast Pueblo and is used as the runoff channel for the St. Charles Flood Ditch. The CF&I Steel Corporation has erected two large reservoirs on the creek to provide water for their industrial processes. There are no stream gages in the study area. Information on past floods was found in historical documents and newspaper files. Discharge data are provided for other streams in the Pueblo area. Flood producing storms over the Salt Creek watershed occur from May through August. Several large highway bridges and smaller railroad bridges are obstructive to floods. One reservoir in the area is effective in reducing flood flow. The Intermediate Regional Flood would have a peak discharge of 9,182 cubic feet per second (cfs) rising 8.5 feet; the duration of flooding is expected to be 18 hours. A peak discharge of 15,129 cfs is estimated for the Standard Project Flood, rising to a height of 11.0 feet and lasting for 21 hours. The report describes guidelines for flood plain management and provides data for locating and designing various structures and channel improvements, and establishing criteria for floodproofing. (Coan-NC)
W79-04865

FLOOD HAZARD ANALYSES: MCKENZIE RIVER, HEDRICKS BRIDGE TO LEABURG DAM, LANE COUNTY, OREGON.
Soil Conservation Service, Portland, OR.
July 1978. 87 p, 2 fig, 62 plates, 1 tab, 17 ref, 8 append.

Descriptors: *Floods, *Flood profiles, *Flood data, *McKenzie River(OR), *Flood plain management, *Flood protection, Flooding, Annual flood, Flood frequency, Flood plains, Lane County(OR), Flood plain zoning, Flood plain insurance, Building codes, Land use, Planning, Zoning, Control structures, Flow control, Levee, Dikes, Reservoirs, Water storage, Channel improvement, Floodproofing, *Oregon, Rivers.

These flood hazard analyses were carried out to identify areas subject to flooding in the McKenzie River drainage area lying on the western slopes of the Cascade Mountain Range in the central portion of western Oregon. The study area is in Lane County, approximately 13 miles east of Eugene. Three villages are within the area, with farms located throughout the length of the valley. The area is mainly agricultural but pressure for residential development is increasing. Most flooding occurs in the winter months, November-March, resulting from heavy rains and snowmelt. Three dams and reservoirs have been constructed in the upper portions of the McKenzie River Valley, reducing the flood potential. A devastating flood in 1964 would have resulted in far greater damage without these dams. This flood approximated a 200-year event. A floodplain zoning ordinance is in effect for Lane County. Floodplain management techniques are discussed, including provision for a floodway, divided into a 'floodway' and 'floodway fringe' area. Detailed maps depicting flood hazard areas are accompanied by flood hazard profiles of Stage 2 conditions on the river. The report recommends that its findings be used as a floodplain management tool by Lane County; that regulations compatible with National Flood Insurance Guidelines be adopted; that new development in the villages of Waterville, Deerhorn, and Leeburg be controlled to avoid damage by the 100-year flood; and that a major floodplain on the north side of the McKenzie River remain in agricultural use to avoid flood damage. (Arnold-NC)
W79-04866

DISAGGREGATION OF STREAMFLOW VOLUMES,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
K. Hoshi, and S. Burges.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, Proceedings Paper 14331, p 27-41, January 1979. 2 fig, 4 tab, 25 ref, 2 append.

Descriptors: *Streamflow, *Model studies, *Hydrology, Probability, Hydraulic models, Stochastic processes, Mathematical studies, Aggregates, Flow, Seasonal, Monthly, Annual, *Probability theory, Aggregation, Aggregation model.

A disaggregation model, which differs from those developed by Valencia and Schaake (VS) and Mejia and Rousselle (MR) (referred to as the HB model), was developed specifically to preserve correlations between seasons joining water years in addition to the properties preserved by the basic VS model. The HB model simultaneously disaggregates two consecutive annual flow volumes, then the next two, etc. The HB model is extended to be able to disaggregate skewed seasonal flows that follow three-parameter log-normal distributions (3PLN). Mixtures of skewed and nonskewed seasonal flow volumes are approximated by 3 PLN distributions for operational convenience. Practical considerations concerning use of these models for multisite flow disaggregation were reviewed, together with computational space requirements and limitations on model computability. A HB 3PLN model for single-site flow disaggregation was used in an example application where comparisons were made with the MR model. (Lee-ISWS)
W79-04878

WALNUT CREEK CHANNEL IMPROVEMENT PROJECT, CONTRA COSTA COUNTY, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. F. George.
Technical Report H-78-14, July 1978. 84 p, 5 tab, 25 photos, 14 pl.

Descriptors: *Channel improvement, *Flow characteristics, *Flood control, *Energy gradients, Hydraulic models, *Walnut Creek(CA).

Tests were conducted on a 1:25-scale model of the covered channels in the city of Walnut Creek where Las Trampas Creek and San Ramon Creek join to form Walnut Creek. The capacity of the existing flood-control channel system was investigated, along with methods for increasing the capacity and improving flow characteristics in the channels. The model was constructed so the slopes of the channels could be adjusted to reproduce various energy gradients resulting from roughness values different than anticipated. Slopes of the model were initially adjusted to produce an energy gradient resulting from a Manning's roughness factor n of 0.012 in the prototype. Maximum discharge capacities were: Las Trampas Creek, 11,000 cfs (100-year frequency flow); San Ramon Creek, 17,400 cfs (2,200 cfs more than the 100-year frequency flow); Walnut Creek conduit, 24,000 cfs. A soffit installed on the bottom of the T-beams on the roof of Walnut Creek increased its capacity to 27,500 cfs. The slopes were readjusted to produce an energy gradient for roughness values that varied from 0.012 to 0.014 and changes in maximum discharge capacities were noted. A new transition design in Las Trampas Creek conduit increased the capacity of the conduit to 11,000 cfs. (WES)
W79-04923

2F. Groundwater

IMPROVEMENT OF THE STEADY FLOATING RANDOM WALK MONTE CARLO METHOD NEAR STRAIGHT LINE AND CIRCULAR BOUNDARIES WITH APPLICATION TO GROUNDWATER FLOW,
Kansas Water Resources Research Inst., Manhattan.
J. H. Turner, L. C. Burmeister, and D. W. Green.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 560, Price codes: A06 in paper copy, A01 in microfiche. Contribution No. 198, December 1978. 101 p, 34 fig, 18 ref, 6 append. OWRT B-045-KAN(1). 14-34-0001-6079.

Descriptors: *Mathematical models, *Monte Carlo method, *Groundwater movement, Groundwater models, Probabilistic models.

Monte Carlo procedures for solving the diffusion equation of heat conduction and flow through porous media have been known for some years. Various investigators have indicated that the so-called floating random walk Monte Carlo procedure offers advantages in terms of computer execution time for single point solutions and complex geometries over finite difference procedures. This work investigates an improvement to the floating random walk. The improvement is based upon the use of exact analytical solutions to the diffusion equation interpreted in probabilistic form. A comparison is made for a number of test cases between what is referred to as a conventional Monte Carlo procedure and the improved Monte Carlo procedure. In addition, a comparison is made to an ADI finite difference procedure. In this comparison, the problem solved was the heat conduction equivalent of a section of the Little Arkansas aquifer system with 18 wells. The geometry was that of a rectangle on three sides with a fourth irregular side representing a river from which fluid entered the aquifer. The manner in which heat conduction parameters can be interchanged in the mathematical model with parameters describing flow through porous media is set forth. The results indicate that the improved Monte Carlo procedure is more efficient than the conventional Monte Carlo procedure in terms of computer execution time and is competitive with, and in some cases, may even be superior to the ADI finite difference procedure.
W79-04557

OCCURRENCE, QUANTITY, AND QUALITY OF GROUND WATER IN TAYLOR COUNTY, TEXAS.
Texas Dept. of Water Resources, Austin.
H. D. Taylor.
Report 224, October 1978. 144 p, 28 fig, 10 tab, 57 ref.

Descriptors: *Texas, *Groundwater, *Groundwater availability, *Water quality, *Data collections, Aquifers, Census, Water wells, Well data, Groundwater resources, Hydraulic properties, Chemical analysis, Drillers logs, Geology, Irrigation wells, Water level fluctuations, Aquifer characteristics, Dissolved solids, Climatology, Groundwater recharge, Geologic formations, *Taylor County(TX), Chemical quality, Choza formation, San Angelo formation, Antlers formation.

The general scope of this study included the collection, compilation, and analysis of data pertaining to the distribution and quality of groundwater in Taylor County. Emphasis was placed on determining the sources of water suitable for domestic, livestock, public supply, industrial, and irrigational uses. Areas and possible sources of present or potential groundwater contamination were determined. Taylor County covers an area of 913 sq mi in west-central Texas. Significant amounts of fresh to moderately saline groundwater occur in aquifers of the Permian, Cretaceous, and Quaternary Systems. The chemical quality of the groundwater varies widely. In general, the water from all water-bearing units is very hard. About 65% of the alluvium groundwater samples in the Tuscola are contained nitrate concentrations ranging from 47 to 326 mg/l. Sewage disposal in Tuscola is by setic tanks, which may account for some of the nitrate. There is slight evidence from 5 wells inventoried in previous years that, historically, nitrate concentrations have been higher in this area than in others. High concentrations of sodium and chloride in groundwater are fairly common over the county and, along with small scattered vegetative-dill areas, may be evidence of groundwater contamination by oil field brines. (Humphreys-ISWS)
W79-04575

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN DAWSON AND BORDEN COUNTIES, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STOR-

AGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-04576

THE WATER WITCH: FACT . . . OR FICTION.
For primary bibliographic entry see Field 7B.
W79-04578

CHEMICAL PRECIPITATION-COAGULATION FOR ORGANIC COLOR REMOVAL FROM GROUNDWATERS,
Mississippi State Univ., Mississippi State.
For primary bibliographic entry see Field 5F.
W79-04614

PUBLIC GROUNDWATER SUPPLIES IN WARREN COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-04720

THE COMPUTATIONAL EFFICIENCY AND TAYLOR EXPANSION DERIVATION OF APPROXIMATING EQUATIONS TO THE GROUNDWATER FLOW EQUATION,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Physics.
L. K. Kuiper.
Water Resources Research, Vol. 14, No. 6, p. 1171-1181, December 1978. 8 fig, 2 tab, 12 ref.

Descriptors: *Groundwater movement, *Subsurface flow, *Groundwater, *Model studies, Mathematical models, Transmissivity, Storage, Storage coefficient, Equations, Mathematics, Numerical analysis, Analytical techniques, Hydraulic similitude.

A general procedure was presented for the derivation of the approximating equations to a differential equation. As is the case with many such approximating equations, values of the dependent variable evaluated at a cluster of points in the independent variable space are related in a relatively simple manner. The total set of such relations, each with a corresponding cluster, one for each of a set of chosen points in the independent variable space, forms the approximating equations to the differential equation. In the procedure presented, each of these relations is formulated by the use of Taylor expansion about a point centrally located within each corresponding cluster. The procedure was used to derive new approximating equations to the one-dimensional groundwater flow equation, both homogeneous and nonhomogeneous. These approximating equations were shown to exhibit superior accuracy and speed in comparison with others that are in common use presently. Twelve different varieties of approximately equations to the one-dimensional homogeneous groundwater flow equation, many of which are in common use, were compared for accuracy. Results of these comparisons and others for the non-homogeneous case showed that approximating equations with higher-order error e give superior results. For any given variety of approximating equations, it was shown that maximum accuracy is achieved when the quantity g, the magnitude of the spacial increment Delta x squared divided by the magnitude of the time increment Delta t, is properly chosen. What this optimal value of g should be was shown to depend upon the error e and character of the approximating equations, the variability and accuracy of the solution being obtained, and the variability of the transmissivity and storage coefficient. (Sims-ISWS)
W79-04737

GROWTH OF GROUNDWATER MOUNDS AFFECTED BY IN-TRANSIT WATER,
Colorado State Univ., Fort Collins. Engineering Research Center.
N. V. Ortiz, D. B. McWhorter, D. K. Sunada, and H. R. Duke.
Water Resources Research, Vol. 14, No. 6, p 1084-1088, December 1978. 8 fig, 13 ref.

Descriptors: *Aquifers, *Groundwater, *Natural recharge, *Model studies, Mathematical models, Equations, Recharge, Groundwater movement, Storage, Storage capacity, Underground storage, Water table, Water levels, Hydrology, *Groundwater mounds, In-transit water.

An analytical solution accounting for the reduction in storage capacity caused by in-transit water was presented. The solution is for the growth of groundwater mounds in an unconfined aquifer in response to uniform deep percolation from a strip of infinite length but finite width. The solution was obtained by integrating the solution for the analogous case of heat flow in a composite solid with respect to time. The aquifer is homogeneous, isotropic, and infinite in areal extent and rests on a horizontal impermeable base. The results from the analytical solution were compared with those obtained from a numerical model which was verified previously with data obtained from a physical porous media model. Dimensionless curves were presented to afford a relatively simple means of analyzing the growth of groundwater mounds. (Sims-ISWS)
W79-04743

DELAYED AQUIFER YIELD AS A PHENOMENON OF DELAYED AIR ENTRY,
Science and Education Administration, Phoenix, AZ., Water Conservation Lab.
For primary bibliographic entry see Field 2G.
W79-04744

ON THE DETECTION OF SHALLOW AQUIFERS USING THERMAL INFRARED IMAGERY,
Connecticut Univ., Storrs. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 7B.
W79-04745

THE CARBON ISOTOPE GEOCHEMISTRY OF A SMALL GROUNDWATER SYSTEM IN NORTHEASTERN ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2K.
W79-04746

A NEW FUNCTION FOR USE IN THE HODOGRAPH METHOD,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
O. D. L. Strack, and M. I. Asgian.
Water Resources Research, Vol. 14, No. 6, p 1045-1058, December 1978. 11 fig, 19 ref, 1 append.

Descriptors: *Groundwater movement, *Groundwater, *Rivers, *Model studies, Mathematical models, Flow, Porous media, Phreatic lines, Water table, Water levels, Seepage, Banks, Hydrology, Riverbanks.

A new function, the reference function, was introduced for combined use with the hodograph. The function is applicable to two-dimensional problems of steady groundwater flow through homogeneously permeable porous media. The reference function is applicable to all problems of the above class with the restriction that the boundary in the hodograph plane be composed of segments of straight lines and circular arcs. The function was determined by application of elementary conformal transformations. Use of the reference function was illustrated for the case of unconfined flow toward a riverbank. A graph was presented that gives the length of the seepage face as a function of the flow parameters. The approach for solving the general problem of the above class by use of the reference function was outlined. (Sims-ISWS)
W79-04748

NUMERICAL MODEL FOR SATURATED-UNSATURATED FLOW IN DEFORMABLE POROUS MEDIA. 3. APPLICATIONS,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 2G.
W79-04749

CARBONATE CHEMISTRY OF GROUNDWATER FROM TROPICAL TOWER KARST IN SOUTH THAILAND,
Hong Kong Univ. Dept. of Geography and Geology.
J. I. Pitman.
Water Resources Research, Vol. 14, No. 5, p 961-967, October 1978. 2 fig, 4 tab, 39 ref.

Descriptors: *Water chemistry, *Groundwater, *Karst, Sampling, Data processing, Limestones, Carbonate rocks, Carbon dioxide, Leaching, Ions, Cations, Anions, Chemistry, Geology, *Thailand, Tropical tower karst, Groundwater chemistry.

Waters from tropical tower karst in an area with no seasonal variations in temperature show marked variations in their dissolved carbonate chemistry. Saturation indices for calcite and dolomite indicate that most samples are saturated to supersaturated with these solids. Recent work has suggested that marked latitudinal gradients exist in the carbonate chemistry of groundwaters in limestones, the principal control being the partial pressure of soil carbon dioxide (PCO2). Calculated log PCO2 values for the waters give a mean of -2.12 + or - 0.41. Measured PCO2 values for the soil atmosphere and soil leachates give a mean log PCO2 of -1.43 + or - 0.07. The wide variation of spring-water PCO2 is best explained by a predominantly closed system evolution from the initial PCO2 of the soil. (Sims-ISWS)
W79-04752

STOCHASTIC ANALYSIS OF SPATIAL VARIABILITY IN SUBSURFACE FLOWS 2. EVALUATION AND APPLICATION,
New Mexico Inst. of Mining and Technology, Socorro.
A. L. Gutjahr, L. W. Gelhar, A. A. Bakr, and J. R. MacMillan.
Water Resources Research, Vol. 14, No. 5, p 953-959, October 1978. 5 fig, 9 ref.

Descriptors: *Subsurface flow, *Groundwater movement, *Model studies, Mathematical models, Stochastic processes, Variability, Spatial distribution, Hydraulic conductivity, Aquifers, Aquitards, Observation wells, Numerical analysis, Analytical techniques, Groundwater.

The stochastic differential equation describing one-dimensional flow in a statistically homogeneous porous medium was solved exactly, and the results were compared with an approximate solution considering small perturbations in the logarithm of the hydraulic conductivity. The results showed that the logarithmic approximation is valid when the standard deviation of the natural logarithm of the hydraulic conductivity. The results showed that the logarithmic approximation is valid when the standard deviation of the natural logarithm of the hydraulic conductivity sigma sub f is less than 1; the errors increase rapidly for sigma sub f greater than 1. The effective hydraulic conductivity of statistically homogeneous media with one-, two-, and three-dimensional perturbations was determined to the first order in (sigma sub f) sq. The effective conductivity was found to be the harmonic mean for one-dimensional flow, the geometric mean for two-dimensional flow, and (1 + (sigma sub f) sq/6)times the geometric mean for three-dimensional flow. The application of stochastic analysis was illustrated through two elementary network design problems that demonstrate the importance of the correlation length of the hydraulic conductivity and the role of measurement error. (See also W78-09199) (Sims-ISWS)
W79-04753

PREDICTIVE ANALYSES OF GROUNDWATER DISCHARGES IN THE WILLOW CREEK WATERSHED, NORTHEAST NEBRASKA,

Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04805

WATER-LEVEL DECLINES IN THE MADISON AREA, DANE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-04809

GALERKIN FINITE ELEMENT PROCEDURE FOR ANALYZING FLOW THROUGH RANDOM MEDIA,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.
B. Sagar.
Water Resources Research, Vol. 14, No. 6, p 1035-1044, December 1978. 5 fig, 2 tab, 18 ref.

Descriptors: *Finite element analysis, *Statistical models, *Groundwater movement, *Heterogeneity, *Hydraulic properties, Flow, Stochastic processes, Porous media, Aquifer characteristics, Probability, Pores, Hydraulic conductivity, Mathematical models, Equations, *Galerkin procedure, Deterministic quantities, Probability mass function.

A method was presented for analyzing flow through a porous medium whose parameters are random functions. Such a medium was conceptualized as an ensemble of media with an associated probability mass function. The flow problem in each member of this ensemble is deterministic in the usual sense. All the solutions belong to a particular Hilbert space, and hence they can be written in terms of linear combinations of its basis functions. This is similar to the Galerkin formulation except that the coefficients in the linear combination are no longer deterministic quantities but random functions. The finite element method in conjunction with a Taylor series expansion was used to get the first two moments of the solution approximately. The method does not require specification of full probability mass functions of the parameters but only their first two moments, and spatial correlations can be accounted for easily. However, it was assumed that the probability mass functions are peaked at the expected value and are smooth in its vicinity. A sample problem was solved to illustrate the procedure. It was observed that the result is sensitive to the element size in the numerical scheme and the variances and spatial correlations of parameters. The expected value of the hydraulic head was found to differ significantly from the results that would have been obtained if the problem had been solved deterministically. (Visocky-ISWS)
W79-04859

ON THE USE OF A MAIN TREND FOR THE KRIGING TECHNIQUE IN HYDROLOGY,
IBM Scientific Center, Venice (Italy).
G. Volpi, and G. Gambolati.
Advances in Water Resources, Vol. 1, No. 6, p 345-349, December 1978. 3 fig, 2 tab, 10 ref.

Descriptors: *Hydrology, *Aquifers, *Model studies, *Mathematical models, Equations, Mathematics, Stochastic processes, Groundwater, Water wells, Water levels, Analytical techniques.

A technique of interpolation based on a stochastic approach and referred to as 'kriging' technique has been contributed recently by the French School. A primary feature of the algorithm is its ability to provide an assessment of the predictive reliability. The accuracy of estimate depends on the evaluation of two stochastic quantities: the variogram, gamma, and the main trend, m, of the hydrologic event, z, to be reconstructed. For an effective use of the method, a correct understanding of the actual role played by m is required. With some ad hoc examples, it was shown that using a polynomial trend with unspecified coefficients as suggested by the general theory may lead to paradoxical results whose behavior is hard to predict a priori. It turned out that increasing the degree of m may yield an increase of the estimation error where one would expect to obtain the opposite. An alternative formulation was suggested which assumes m to be fully known in advance. Its expression was supposed to be derived from both the general behavior of z as is recognizable from the available records and some extra-amount of information related to the general physical knowledge of the hydrological context. If this extra-amount of information related to the general physical knowledge of the hydrological context. If this extra-amount of information is missing, the use of a constant trend should be recommended. (Sims-ISWS)
W79-04870

ILLINOIS COASTAL ZONE MANAGEMENT PROGRAM, 2ND YEAR WORK PRODUCT. VOLUME II. COASTAL GEOLOGICAL STUDIES, HYDROGEOLOGIC, GEOLOGIC, AND ENGINEERING ASPECTS OF LAKE MICHIGAN SURFICIAL DEPOSITS,
Illinois State Dept. of Transportation, Chicago. Div. of Water Resources.
P. B. DuMontelle, K. L. Stoffel, and J. J. Brossman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 153, Price codes: A06 in paper copy, A01 in microfiche. 1976. 105 p, 17 fig, 2 tab, 19 ref, 2 append.

Descriptors: *Shore protection, *Erosion, *Erosion control, *Seepage, *Hydrogeology, *Lake Michigan(IL), *Illinois, *Coastal Zone management, Soil stability, Slope protection, Slope stability, Infiltration, Groundwater, Groundwater movement, Geology, Drainage, Foundation strengths, Bluffs.

This report describes the basic characteristics that determine erosion susceptibility, foundation stability, weathering qualities, slump resistance, and drainage performance of the Illinois-Lake Michigan shore bluffs. Geologic data on sediment characteristics and clay mineralogy are presented with appropriate figures. Foundation strengths, uncombined compressive liquid strengths, moisture content, liquid limits, plasticity indices, shear strengths and wet/dry densities were also measured. The geologic data were gathered from bluff exposures of the area and 14 research boreholes in addition to previously collected information. Groundwater data were gathered from weather records, piezometer installations at Lake Bluff, and bluff-line seep studies along the entire shore. Significant groundwater seepage on the bluff face was mapped in 7 areas which are described extensively. Appendix A includes tables presenting the geologic and engineering data from the boreholes and geologic outcrop sections. The tables give descriptions of each sample including depth, a graphic log, index properties, grain-size fractions and X-ray data. Appendix B includes engineering measurements made of samples available from cross-section boreholes. (Coan-NC)
W79-04874

2G. Water In Soils

HYDROLOGIC BEHAVIOR OF A FORESTED MOUNTAIN SOIL IN COASTAL BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Soil Science.
J. de Vries, and T. L. Chow.
Water Resources Research, Vol. 14, No. 5, p 935-942, October 1978. 4 fig, 1 tab, 17 ref.

Descriptors: *Forest soils, *Canada, *Hydrologic properties, *Soil water movement, On-site investigations, Simulated rainfall, Model studies, Mathematical models, Mountains, Forests, Soil water, Infiltration, Wetting, Drainage, Hydraulic conductivity, Soils, Soil horizons, Soil science, *British Columbia.

Inferences with respect to the hydrologic behavior of a West Coast forested mountain soil were based on measurement of the water potential field during the wetting and drainage phases of simulated rainfall events. The field was measured as a continuous function of time with an array of 13 tensiometers in combination with pressure transducers and a data collection system. Measurements were carried out with the forest floor intact, partly disturbed, and totally removed. Inferences were made by interpreting the water potential fields as 'fingerprints of hydrologic behavior.' It was concluded that during a simulated rainfall event, water flow through the profile was partitioned between root channels and the soil matrix which is transversed by the channels. The proportion of the flow conducted by the channels was at its maximum during the non-steady state phase of the event, decreasing to a minimum as steady-state was approached. During the drainage phase of the event, the channels did not contribute to downward flow. The process of internal infiltration was discussed. It causes the soil matrix to wet up both from the surface of the H horizon of the forest floor and from the wetted periphery of the root channels. Results indicated that simulated disturbance of the forest floor down to the mineral soil caused a shift in the water flow pathway from the channels to the soil matrix. It was speculated that this shift was due to closure of the channel openings. It was speculated that the flashy response of streams to rainfall events is related to rapid subsurface storm flow through root channels. Also, because water flow through the soil matrix is much slower than that through root channels, it is likely that forest floor disturbance on a watershed-wide scale would result in an increase in the time lag between the rainfall event and the corresponding streamflow event. (Sims-ISWS)
W79-04564

THE ROLE OF PLANT RESIDUES IN THE FATE OF CADMIUM IN ECOSYSTEMS. A BUFFER AGAINST CONTAMINATION OF WATER SOURCES,
Delaware Univ., Newark. School of Life and Health Sciences.
For primary bibliographic entry see Field 5B.
W79-04584

TIME-DEPENDENT SOLUTIONS TO THE ONE-DIMENSIONAL LINEARIZED MOISTURE FLOW EQUATION WITH WATER EXTRACTION,
Arizona Univ., Tucson. Dept. of Mathematics.
D. O. Lomen, and A. W. Warrick.
Journal of Hydrology, Vol. 39, No. 1/2, p 59-67, October 1978. 3 fig, 12 ref, 1 append. OWRT B-045-ARIZ(10), B-064-ARIZ(2).

Descriptors: *Soil water, Analysis, *Unsteady flow, *Unsaturated flow, Soil water, Infiltration, Drainage, Equations, Conductivity, Saturation, Porous media, Transpiration.

An exact, analytical solution was developed for one-dimensional soil water flow. Assumptions are that the unsaturated conductivity is exponential with pressure head and that the soil moisture diffusivity constant. The surface boundary condition was taken as a time-dependent specified-intake velocity. A sink function for a plant water uptake was described by a sequence of depth-dependent functions which change at specified times. Numerical examples included drainage, infiltration, steady uptake and cyclic surface flux, and uptake patterns. The linearizing assumptions are the most realistic for short cycles, but in any case, the exact nature of the answers make them ideal for checking numerical approximations, such as finite differencing. (Adams-ISWS)
W79-04602

USE OF METHANOL-WATER SOLUTIONS FOR FREEZE PROTECTION OF TENSIOMETERS,
Texas A and M Univ., Lubbock. Agricultural Research and Extension Center.
For primary bibliographic entry see Field 3F.
W79-04605

BASIC MATHEMATICAL MODELS OF TOXICANT TRANSPORT THROUGH THE SOIL PROFILE,
Moskovskaya Selskokhozyaistvennaya Akademiya (USSR).
For primary bibliographic entry see Field 5B.
W79-04649

THE EFFECT OF SALT PRECIPITATION AND HIGH SODIUM CONCENTRATIONS ON SOIL HYDRAULIC CONDUCTIVITY AND WATER RETENTION,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. Frenkel, A. Hadas, and W. A. Jury.
Water Resources Research, Vol. 14, No. 2, p 217-222, April, 1978. 5 fig, 4 tab, 21 ref.

Descriptors: *Saline water, Salinity, Irrigation, Leaching, Crop response, Chemical precipitation, Hydraulic conductivity, *Soil-water-plant relationships.

Controlled irrigation management of moderate to poor quality water must assure sufficient movement of solution through the root zone to maintain a salinity regime which a crop can tolerate while at the same time minimizing the deterioration of groundwater or river quality. The work reported here analyzes the major plant-soil-salinity interactions resulting from irrigation with saline water at controlled leaching fractions. Simulations are run for leaching fractions of 0.30, 0.05, and 0.01 and three different water uptake patterns for two high-sulfate waters with different salinity levels: 2.1 and 6.6 mmho/cm. Results suggest that soil hydraulic conductivity and water retention should not be adversely affected by high sodium levels or cumulative salt precipitation even at very low leaching fractions. However, it is probable that plant activity will be impaired by the lower leaching fractions because of high osmotic pressure within the root zone and that root proliferation could be reduced by soil structure cementation resulting from salt precipitation. (Skogerboe-Colorado State).
W79-04650

CALCIUM-SUPPLYING CHARACTERISTICS OF TWO GYPSUM MATERIALS ON SOUTHEASTERN COASTAL PLAIN SOILS,
Texas A and M Univ., Overton. Agricultural Research and Extension Center.
T. C. Keisling, and M. E. Walker.
Soil Science Society of America Journal, Vol. 42, No. 3, p 513-517, May-June, 1978. 2 fig, 2 tab, 16 ref.

Descriptors: *Gypsum, *Calcium sulfate, Peanuts, Granules, *Soil leaching, Particle size, Coastal plains.

Field studies were conducted on two soils to study the manner in which finely and coarsely divided gypsum materials supplied Ca to the soil depth where peanut (Arachis hypogaea L.) fruit absorb Ca. The finely divided material was characterized chemically as CaSO4.2H2O, approximately 72% CaSO4 or 20.2% Ca and physically as having 88% of the particles < 0.25 mm in diameter. The coarsely divided material was characterized chemically as CaSO4, approximately 92% CaSO4 or 26.5% Ca and physically as having 82% with particle diameters < 4.2 mm, but > 0.5 mm. The amount of Ca transported to a given soil depth was found to be related to the magnitude, order, and frequency of rainfall events. The fine gypsum material was found to be more effective in supplying Ca to the soil depth where peanut fruit are absorbing it early in the growing season than the coarser material. Dissolution of gypsum sources consisting of different particle sizes and subsequent transport of Ca into the fruiting zone of peanuts was not always closely related to the total amount of rainfall. Either the finely or coarsely divided gypsum could supply more Ca to the fruiting zone depending on the rainfall pattern. (Skogerboe-Colorado State)
W79-04662

CHANGES IN BIOCHEMICAL CHARACTERISTICS OF CHERNOZEM SOILS IN THE REGION OF THE WESTERN SLOPE OF THE URAL MOUNTAINS DURING IRRIGATION,
Akademiya Nauk SSSR, Ufa. Inst. of Biology.
I. K. Khabirov, Kh. Khaziev, and F. Sh. Garifullin.
Biol Nauki (Mosc) Vol. 19, No. 10, p 115-122. 1976.

Descriptors: *Irrigation effects, *Chernozems, Soil chemical properties, Sugar beets, Soil biology.

The effects of irrigation on the biochemical activity of the cherozem soils of the western slope areas of the Ural Mountains of the Bashkir ASSR (USSR) were studied. Correlations between enzyme activities, nutrient content, rates of O2 consumption and CO2 production, moisture and sugar beet yield were made. Activity rates of phosphatases, saccharases, ureases, dehydrogenases, soil proteases, O2 consumption and CO2 production all increased as a result of irrigation. Effectiveness of irrigation increased with use of fertilizers (N, P and K) and deep soil tilling. Copyright 1978, Biological Abstracts, Inc.
W79-04706

TOWARD MORE DETAILED FIELD MONITORING OF VARIABLE SOURCE AREAS,
Bristol Univ. (England). Dept. of Geography.
M. G. Anderson, and T. P. Burt.
Water Resources Research, Vol. 14, No. 6, p 1123-1131, December 1978. 10 fig, 1 tab, 36 ref.

Descriptors: *Soil water movement, *On-site investigations, *Subsurface drainage, Soil water, Rainfall, Precipitation(Atmospheric), Runoff, Streamflow, Hydrographs, Tensiometers, Networks, Instrumentation, Soil water, Potential flow, Subsurface flow, Monitoring, Water sources, Hillslopes, Hollows, Soil water potential.

Variable source area storm flow generation is now a well-accepted process in natural catchments. Although the concept of variable source areas, together with more theoretical modeling, has received much recent attention, detailed field delineation, both seasonally and for short storms, has not. The work reported here used an automatic tensiometer system to obtain continuous data on soil water potential status in a hill-slope hollow. The results discussed demonstrate that source areas can be accurately delineated by such equipment and that hollows are significant source areas at all stages of drainage. Moreover, the convergence shown by the soil water flow nets in such source areas remains almost constant throughout the year. (Sims-ISWS)
W79-04739

IS THE SOIL FROZEN OR NOT. AN ALGORITHM USING WEATHER RECORDS,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. W. Cary, G. S. Campbell, and R. I. Papendick.
Water Resources Research, Vol. 14, No. 6, p 1117-1122, December 1978. 5 fig, 2 tab, 13 ref.

Descriptors: *Frozen soils, *Weather data, *Algorithms, Mathematical models, Soils, Vegetation effects, Vegetation, Temperature, Air temperature, Solar radiation, Precipitation(Atmospheric), Rainfall, Snowfall, Heat flow, Thawing, Freezing, Soil science, Meteorology.

Frozen soil water is important in hydrologic events because it reduces water infiltration. The presence of soil ice can be predicted reasonably well from detailed knowledge of the soil and microclimatic variables, but this type of information is generally unavailable. Consequently, the purpose of this study was to start with fundamental relations and to see how well frozen soil conditions could be identified from daily weather station records of maximum-minimum temperature, solar radiation, and snowfall. Two relations were developed, one based on the soil-atmosphere energy budget and the other on the heat flux across the soil surface layer. Conceptually, the two equations may be used together to give daily snowmelt as well as soil thawing and freezing rates, but in practice, the snowmelt prediction is probably not yet accurate enough for most practical applications. The simpler equation, describing the heat flux in the soil surface, did not require solar radiation input, yet it gave fair predictions of frozen soil on five diverse sites studied in the Palouse region of eastern Washington. Both approaches required only a single constant that accounts for individual site conditions such as slope, aspect, cover, and soil properties. (Sims-ISWS)
W79-04740

DELAYED AQUIFER YIELD AS A PHENOMENON OF DELAYED AIR ENTRY,
Science and Education Administration, Phoenix, AZ., Water Conservation Lab.
H. Bouwer, and R. C. Rice.
Water Resources Research Research, Vol. 14, No. 6, p 1068-1074, December 1978. 8 fig, 10 ref.

Descriptors: *Aquifers, *Pore water, *Water yield, *Soil water movement, Air, Vadose water, Laboratory tests, Mathematical models, Air-earth interfaces, Soil water, Drawdown, Wells, Pumping, Groundwater, Air entry, Delayed aquifer yield.

Delayed release of pore water from a pumped, unconfined aquifer was treated as a situation of restricted air movement in the vadose zone due to layers of high water content. This restricted movement produces below-atmospheric pressures in the pore air above the water table, which cause the water table initially to drop faster than the dewatered zone. The initial yield was less than the full specific yield, which developed after a certain water table drop. Equations were derived that relate delayed yield to air entry value and height above water table of saturated layers in the vadose zone. These equations agreed with results from a delayed yield experiment on a vertical soil column and produced ratios between initial and final yield that resembled those calculated by others from actual pumping tests. An axisymmetric flow system, simulated by interconnected jars with narrow standpipes, produced delayed yield drawdown curves that were amenable to Boulton's analysis. (Sims-ISWS)
W79-04744

NUMERICAL MODEL FOR SATURATED-UNSATURATED FLOW IN DEFORMABLE POROUS MEDIA. 3. APPLICATIONS,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan, and P. A. Witherspoon.
Water Resources Research, Vol. 14, No. 6, p 1017-1034, December 1978. 46 fig, 1 tab, 26 ref.

Descriptors: *Porous media, *Saturated flow, *Unsaturated flow, *Model studies, Mathematical models, Numerical analysis, Groundwater, Groundwater movement, Soil water, Soil water movement, Subsidence, Land subsidence, Earthquakes, Construction, Soils, Soil properties, Infiltration, Drainage, Subsurface drainage, Pore pressure, Soil science.

This was the third and conclusive part of a three-part series. The paper described the application of a numerical model for saturated-unsaturated flow in deformable porous media. In all, 10 illustrative examples were presented which not only demonstrated the validity of the method, but also highlighted the fundamental unity that exists in the physic principles of the fields of hydrogeology, soil mechanics, and soil physics. The chosen examples involved such diverse phenomena as soil consolidation, infiltration, and drainage and generation of fluid pressures due to such cyclic loading as earthquakes. (See also W77-11223 and W78-09195) (Sims-ISWS)
W79-04749

RATE OF CAPILLARY WATER ASCENT AS DEPENDENT ON PHYSICAL SOIL PROPERTIES, (IN CZECH),
J. Mistina, and A. T. Kosik.

Ved Pr Vysk Ustavu Rastlinnej Vyroby Piestanoch (13), p 309-316, 1976. (English summary).

Descriptors: *Capillary action, Chernozems, Porosity, *Soil physical properties, Soil water movement, Specific gravity.

Capillary water movement in a chernozem soil correlated positively with soil aggregate diameter and specific gravity; negatively with total porosity and air capacity.
W79-04751

RAPID DETERMINATION OF SOIL WATER CHARACTERISTIC BY THERMOCOUPLE PSYCHROMETRY,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
F. R. Riggle, and D. C. Slack.
Paper No. 78-2026, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 24 p, 6 fig, 1 tab, 34 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Soil water, Moisture content, Moisture tension, Soil moisture, Moisture availability, Soil tests, Osmotic pressure.

A procedure was developed for determination of the soil water characteristic curve with thermocouple psychrometry. Complete soil water characteristic curves were obtained for a Nicollet clay loam, a Waukegan silt loam, and a Hubbard sandy loam within one week in ambient air conditions. The curves obtained by the psychrometer method compared favorably with those obtained by pressure methods. (Skogerboe-Colorado State)
W79-04987

NUTRIENT EFFECTIVENESS IN RELATION TO RATES APPLIED FOR POT EXPERIMENTS: I. NITROGEN AND POTASSIUM,
National Fertilizer Development Center, Muscle Shoals, AL.
G. L. Terman, and J. J. Mortvedt.
Soil Science Society of America Journal, Vol. 42, No. 2, p 297-302, March-April, 1978. 7 fig, 7 ref.

Descriptors: Fertilizers, Nutrients, *Nitrogen, *Potassium, Phosphorus, Rates of application, Greenhouses, Corn(Field), Rice, Crop response.

A N source experiment was conducted on infertile Mountview sil (Typic Paleudult) to evaluate for N sources at multiple rates of applied N and P. Granular ammonium nitrate (AN), sulfur-coated urea (SCU), oxamide (Ox), and isobutylidene diurea (IBDU) were evaluated for corn (Zea mays L.) at N rates of 0, 400, 800, and 1,200 mg/pot (5 kg of soil), each at P rates of 0, 60, 120, 480, and 960 mg/pot. Yield response to applied N was in the order AN >> SCU > Ox > IBDU at the higher rates of applied P. At 60 and 120 mg of applied P/pot, however, P was too deficient for satisfactory evaluation of the N sources. In an experiment with flooded rice (Oryza sativa L.), P limited yields less than did N. In other N-P and P-K factorial experiments, rates of other nutrients and length of growth period also greatly affected crop response to applied N and K. (See also W79-04993)(Skogerboe-Colorado State)
W79-04992

NUTRIENT EFFECTIVENESS IN RELATION TO RATES APPLIED FOR POT EXPERIMENTS: II. PHOSPHORUS SOURCES,
National Fertilizer Development Center, Muscle Shoals, AL.
J. J. Mortvedt, and G. L. Terman.
Soil Science Society of America Journal, Vol. 42, No. 2, p 302-306, March-April, 1978. 4 fig, 3 tab, 12 ref.

Descriptors: Nutrients, Rates of application, Phosphorus compounds, Fertilizers, Greenhouses, Corn(Field), Crop response, Crop production.

Three greenhouse pot experiments were conducted with corn (Zea mays L.) grown on infertile soils to evaluate four fertilizers as sources of P. The granular sources were concentrated superphosphate (CSP, 90% of P water-soluble), monoammonium phosphate (MAP, 100% of P water-soluble), a mixture of 30% of the P as CSP and 70% as dicalcium phosphate (DCP, water-insoluble), and a 10-90% mixture of CSP and DCP. Various rates of P per plot from each source were compared. These P sources and rates were compared at various levels of N and K. The order of effectiveness was the same at all levels of applied N and K: MAP > CSP > 30% CSP + 70% DCP > 10% CSP + 90% DCP. This indicates that on these soils, P was the chief limiting nutrient at all levels of N and K. However, yield levels and the precision of determining differences in effectiveness among sources relative to experimental error increased greatly at higher rates of applied N and K. (See also W79-04992)(Skogerboe-Colorado State)
W79-04993

2H. Lakes

LIMNOLOGICAL ASPECTS OF LAKE MEAD, NEVADA-ARIZONA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. R. Baker, J. E. Deacon, T. A. Burke, S. S. Egdorf, and L. J. Paulson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 507, Price codes: A05 in paper copy, A01 in microfiche. Report No. REC-ERC-77-9, June 1977. 90 p, 18 fig, 32 tab, 129 ref, 3 append.

Descriptors: *Limnology, *Water quality, *Lake Mead(Nevada-Arizona), Las Vegas(Nevada), Phytoplankton, Zooplankton, Bacteria, Aquatic environment, Eutrophication, Water pollution sources, Water pollution effects, Water temperature, Dissolved oxygen, Alkalinity, Water chemistry, Environmental effects, Industrial wastes, Sewage effluents.

Lake Mead, classified as a deep, subtropical, moderately productive desert impoundment with a negative heterograde oxygen profile during the summer, was studied to determine its water quality aspects with regard to the effluents discharged to it by Las Vegas. The study was initiated in 1971. Biweekly and monthly measurements were made of water temperature, dissolved oxygen, conductivity, pH, alkalinity, nutrient concentrations, phytoplankton numbers, chlorophyll a, primary productivity, zoopla ton, concentrations, and coliform bacteria. Phytoplankton and zooplankton success patterns are described. The factors affecting the deposition and distribution of enteric bacteria in Las Vegas Bay are discussed. The distribution of water and enteric bacteria of possible fecal origin into Las Vegas Bay from Las Vegas Wash were determined. The standard methods and techniques for enteric bacteria are examined. The metalimnetic oxygen minimum was caused by biological respiration of the zooplankton and phytoplankton. The high algal biomass and primary production in Las Vegas Bay are caused by the nutrients carried by the dense current on the bottom of the Bay from Las Vegas Wash. The inner portion of Las Vegas Bay is classified as eutrophic, while the outer portion and Boulder Basin are classified as mesotrophic. The most limiting nutrient appears to be nitrogen. (Davison-IPA)
W79-04506

PUBLIC PERCEPTIONS OF ISSUES AND PROBLEMS IN THE LAKE CHAMPLAIN BASIN AREA, A SUMMARY,
Cornell Univ., Ithaca, NY.
H. R. Capener, P. H. Gore, F. F. Schmidt, J. L. Lapi, and T. B. Quinlan.
Lake Champlain Basin Study, New England River Basins Commission, Burlington, Vermont, May, 1978. 56 p, 7 fig, 7 tab, 38 ref.

Descriptors: *Lakes, *Surveys, *Human populations, Census, Investigations, Water users, Water pollution, Wetlands, Land use, Recreation.

The Lake Champlain Basin Study originally identified 13 major work elements for carrying out the regional planning process. Of these work elements, seven major issue areas were selected for inclusion in questionnaires for high school students, key informants, and representatives of organizations. Basin-wide, water pollution concerns were ranked first by both in high school students and representatives of the organizations, and was a close second with the key informants. Land use and recreational issues were ranked second and third. Wetlands issues such as protection of fish and wildlife habitats, game management areas, and bog preservation were fourth. Energy, socio-economic, and planning and management were the last three major issue areas. (Steiner-Mass)
W79-04558

RESERVOIR SYSTEM OPERATING POLICY--CASE STUDY,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 6A.
W79-04616

PHOSPHORUS LOADINGS TO LAKES AND SOME OF THEIR RESPONSES. PART 1. A NEW CALCULATION OF PHOSPHORUS LOADING AND ITS APPLICATION TO 13 NEW YORK LAKES,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
For primary bibliographic entry see Field 5B.
W79-04621

PHOSPHORUS LOADINGS TO LAKES AND SOME OF THEIR RESPONSES. PART 2. REGRESSION MODELS OF SUMMER PHYTOPLANKTON STANDING CROPS, WINTER TOTAL P, AND TRANSPARENCY OF NEW YORK LAKES WITH KNOWN PHOSPHORUS LOADINGS,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
For primary bibliographic entry see Field 5B.
W79-04622

DISSOLVED OXYGEN DEMAND OF REDUCED CHEMICAL SPECIES IN THE WATER COLUMN OF SEBASTICOOK LAKE, MAINE,
Maine Univ. at Orono.
F. P. Liotta.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 680, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, May 1979. 43 p, 4 fig, 5 tab, 50 ref, 2 append. OWRT A-039-ME(2). 14-34-0001-7042.

Descriptors: *Chemical oxygen demand, Eutrophication, Geochemistry, *Lakes, Water chemistry, Sebasticook Lake, Hypolimnion.

Fifty water column profiles were sampled at Sebasticook Lake, Penobscot County, Maine to determine the impact of reduced chemical species on the dissolved oxygen content of this culturally eutrophic lake. Reduced chemical species measured were CH4g, Fe+2, Mn+2, and total sulfide. Chemical oxygen demand due to eddy diffusion of these chemical species from the anoxic hypolimnion to the epilimnion during summer stratification is capable of causing the anoxic boundary to migrate upward at a rate of 1 m in 7.0 days. Methane is the most abundant reduced chemical species present and is responsible for 88% of the chemical oxygen demand. NH3g generation is believed to be indirectly responsible for the great increase in alkalinity in the anoxic hypolimnion. As NH3g dissolves in the hypolimnion, the resulting OH-aq serve as a H+aq sink, thus allowing an excess of HCO-3aq and CO-3aq to accumulate as CO2g dissolves in the lake water. NH+4aq also helps to satisfy electrical neutrality in the anoxic bottom waters. The solubility products of vivianite, troilite, and rhodochrosite are exceeded in the deepest waters of Sebasticook Lake during summer stratification. Precipitation of rhodochrosite can explain the apparent buffering of Mn+2aq and the break

in the alkalinity profile. Troilite precipitation can explain the decrease in total sulfide concentration in the deepest samples. The concentration of Fe+2aq is 1 to 2 orders of magnitude greater than total sulfide and is thus insignificantly affected by the precipitation of troilite. Acidification of unfiltered lake water samples can result in dissolution of particulate or colloidal Fe, thus yielding high values for dissolved Fe.
W79-04684

THREE-DIMENSIONAL TEMPERATURE MODEL FOR SHALLOW LAKES,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
For primary bibliographic entry see Field 5B.
W79-04731

POSTIMPOUNDMENT SURVEY OF WATER-QUALITY CHARACTERISTICS OF RAYSTOWN LAKE, HUNTINGTON AND BEDFORD COUNTIES, PENNSYLVANIA,
Geological Survey, Pittsburgh, PA. Water Resources Div.
D. F. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A061 737, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-42, July 1978. 53 p, 8 fig, 12 tab, 16 ref.

Descriptors: *Post-impoundment, *Lakes, *Water quality, *Limnology, *Nutrients, Inflow, Discharge(Water), Water analysis, Thermocline, Stratification, Turnovers, Seasonal, Eutrophication, Physical properties, Chemical properties, Biological properties, Pennsylvania, *Raystown Lake.

Water-quality data, collected from May 1974 to September 1976 at thirteen sites within Raystown Lake and in the inflow and outflow channels, define the water-quality characteristics of the lake water and the effects of impoundment on the quality of the lake outflow. Depth-profile measurements show Raystown Lake to be dimictic. Thermal stratification is well developed during the summer. Generally high concentrations of dissolved oxygen throughout the hypolimnion during thermal stratification, low phytoplankton concentrations, and small diel fluctuations of dissolved oxygen, pH, and specific conductance indicate that the lake is low in nutrients, or oligotrophic. Algal assays of surface samples indicate that orthophosphate was a growth-limiting nutrient. The diatoms (Chrysophyta) were the dominant phytoplankton group found through-out the study period. The lake waters contained very low populations of zooplankton. Fecal coliform and fecal streptococcus densities measured throughout the lake indicated no potentially dangerous areas of water-contact recreation. The most apparent effect that the impoundment had on water quality was the removal of nutrients, particularly orthophosphate, through phytoplankton uptake and sediment deposition. (Woodard-USGS)
W79-04806

IRREGULAR WAVE RUNUP AND OVERTOPPING,
Coastal Engineering Research Center, Fort Belvoir, VA.
J. P. Ahrens, and M. F. Titus.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 104, No. WW4, Technical Note, p 439-442, November 1978. 1 fig, 5 ref, 1 append.

Descriptors: *Ocean waves, *Breakwaters, *Wave pile-up, Waves(Water), Coastal structures, Analysis, Equations, Mathematical studies, *Wave height, *Overtopping, Wave runup, Wave spectra, Significant wave, Rayleigh distribution.

Irregular wave overtopping rates for coastal structures are computed with wave runup assumed to have a Rayleigh distribution. Computing irregular wave overtopping rates is easy because they can be treated as a correction to the overtopping rates for the equivalent monochromatic wave conditions. The average irregular wave overtopping rates are lower than the equivalent monochromatic rates for most freeboard conditions. The Rayleigh distribution seems conservative for predicting runup heights, but it is not clear that it also gives conservative overtopping rates. The effects of offshore depths and the reduced run-back when overtopping occurs were not evaluated. (Adams-ISWS)
W79-04814

2I. Water In Plants

DRY MATTER PRODUCTION AND TRANSLOCATION IN MAIZE SUBJECTED TO DROUGHT DURING GRAIN FILL,
Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
S. K. Jurgens, R. R. Johnson, and J. S. Boyer.
Agronomy Journal, Vol. 70, No. 4, p 678-682, July-August, 1978. 5 fig, 5 tab, 17 ref. OWRT A-070-ILL(2).

Descriptors: *Corn(Field), Moisture stress, Moisture deficit, *Photosynthesis, Translocation, Crop response, Crop production.

The objective of this research was to study the problem of yield loss to be expected and the physiological mechanism that cause the loss due to dry conditions most frequently occurring during the second half of the growing season of maize (Zea mays L.). Drought was imposed during the grain filling stage of maize to determine its relative effects on photosynthesis and translocation. (Skogerboe-Colorado State)
W79-04606

PHOTOSYNTHESIS, TRANSPIRATION, AND LEAF ELONGATION IN CORN SEEDLINGS AT SUBOPTIMAL SOIL TEMPERATURES,
Macquarie Univ., North Ryde (Australia). School of Biological Sciences.
E. W. R. Barlow, L. Boersma, and J. L. Young.
Agronomy Journal, Vol. 69, No. 1, p 95-100, January-February 1977. 7 fig, 33 ref. OWRT-B-028-ORE(6).

Descriptors: Plant physiology, Crop response, Soil temperatures, *Photosynthesis, Corn, *Transpiration, Soil temperature.

The physiology of plant response to low soil temperatures is not well understood. Laboratory studies were conducted to examine the relative sensitivities of rates of leaf elongation, net photosynthesis, and transpiration and the leaf water potential of corn seedlings to decreasing temperature. These parameters were simultaneously monitored, as the soil temperature was decreased from 28 to 10 C at about 4 C increments. The different soil temperatures were imposed during a 10-hour peiod on 14-day-old plants with seven exposed leaves growing at 27.5 C air temperature, a 55% relative humidity, and a light intensity of 753 muE/m2/sec. Any decrease of the soil temperature below 28 C decreased the leaf elongation rate. This was attributed to restricted water uptake which lowered the plant water potential and to the temperature decrease of the shoot apical meristem region. Leaf elongation ceased at the plant water potential of -9 bars due to decline of leaf turgor pressure. (Skogerboe-Colorado State).
W79-04608

THE RELATIONSHIP BETWEEN ABOVEGROUND AND BELOWGROUND BIOMASS OF FRESHWATER TIDAL WETLAND MACROPHYTES,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
D. F. Whigham, and R. L. Simpson.
Aquatic Botany, Vol. 5, (1978), Elsevier Scientific Publishing Company, Amsterdam, The Netherlands, 10 p, 2 figs, 1 tab, 26 refs. OWRT B-060-NJ(1). 14-34-0001-6099.

Descriptors: *Freshwater marsh, Nutrients, Organic matter, *Biomass, *Wetland, Tidal effects, Decomposition.

Aboveground and belowground biomass relationships of 15 annual and perennial freshwater tidal wetland macrophytes were examined. The data showed that regression equations may be used with confidence to estimate belowground biomass from aboveground biomass for most species. The linear regression model was suitable except for one species which had a large belowground component and for which the exponential model was more appropriate. Belowground:aboveground biomass ratios were significantly different for the 8 annual species examined. At peak biomass, all annuals allocated less than one third of the total net annual production into belowground structures. They exhibited distinct seasonal patterns of biomass allocation with more biomass incorporated into belowground components during the early part of the growing season. Perennial species exhibited 4 patterns of biomass allocation with Peltandra virginica (L.) Kunth having a significantly greater mean belowground:aboveground biomass ratio than other perennials. Factors that may control biomass allocation patterns include depth of rooting and life history strategies.
W79-04627

2J. Erosion and Sedimentation

SEDIMENTATION IN A 'HALF-TIDE' HARBOR, PART 1. SEDIMENTATION UNDER ICE-FREE CONDITIONS,
Coastal Engineering Research Center, Fort Belvoir, VA.
C. H. Everts.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 667, Price codes: A03 in paper copy, A01 in microfiche. In: Assessment of the Arctic Marine Environment: Selected Topics, Institute of Marine Science, University of Alaska, Fairbanks, 1976. 16 p, 9 fig, 1 tab, 3 ref.

Descriptors: *Arctic, *Harbors, *Sedimentation rates, *Alaska, *Suspended solids, *Dredging, Tidal effects, Estuaries, Tides, Currents(Water), Sediment distribution, Sedimentation, *Small craft harbors, *Arctic estuaries, *Dillingham(AK).

Harbor shoaling becomes a significiant problem when coastal waters are laden with suspended solids and the tidal range is high. Because of currents resulting from the tides and severe ice conditions which exist along much f the Alaskan coast, some smallcraft harbors are constructed as enclosed basins sited adjacent to, rather that within, navigable estuaries. Determination of the shoaling rate and relative importance of factors involved in the shoaling process is essential to the effective design of these harbors. The unique feature of the 'half-tide' harbor is a sill placed in the navigation channel at an elevation greater than that of the basin. Flotation for vessels is provided during low-tide stages, but the sill restricts navigation into and out of the harbor to times of higher tidal elevations. This report described the history and processes of shoaling observed during the ice-free season at an enclosed small-craft harbor at Dillingham, Alaska, since its construction in 1961. (See also W79-04562) (Adams-ISWS)
W79-04562

SEDIMENTATION IN A 'HALF-TIDE' HARBOR, PART 2. SEDIMENTATION DURING PERIODS OF ICE-COVER,
Coastal Engineering Research Center, Fort Belvoir, VA.
C. H. Everts.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 667, Price codes: A03 in paper copy, A01 in microfiche. In: Assessment of the Arctic Marine Environment: Selected Topics, Institute of Marine Science, University of Alaska, Fairbanks, 1976. 13 p, 9 fig, 2 ref.

Descriptors: *Arctic, *Harbors, *Sedimentation rates, *Alaska, *Suspended solids, *Dredging, Tidal effects, Estuaries, Tides, Currents(Water), Sediment distribution, Sedimentation, Ice cover, *Small craft harbors, *Arctic estuaries, *Dillingham(AK).

Harbor shoaling is a significant problem when coastal waters are laden with suspended solids and the tidal range is high. Because of tidal currents and severe ice conditions, some small-craft harbors are enclosed basins adjacent to, rather than within, navigable estuaries. The 'half-tide' harbor has a sill in the navigation channel at an elevation greater than that of the basin. Seasonal ice cover often limits the use of small-craft harbors in the northern regions to a few summer months. The role that ice plays in sedimentation may be an important consideration in harbor design. A study was conducted during the ice season in 1973 and 1974 at a harbor near Dillingham, Alaska, to determine the winter shoaling rate and the mechanisms that contribute to winter sedimentation. The purpose of the study, reported herein, was to develop a method to predict quantitatively the difference between winter and summer shoaling rates and to evaluate possible solutions to reduce winter shoaling. (See also W79-04562) (Adams-ISWS)
W79-04563

LONG-TERM PATTERNS OF SEDIMENT PRODUCTION FOLLOWING ROAD CONSTRUCTION AND LOGGING IN THE OREGON COAST RANGE,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
R. L. Beschta.
Water Resources Research, Vol. 14, No. 6, p 1011-1016, December 1978. 7 fig, 1 tab, 24 ref.

Descriptors: *Sediments, *Suspended solids, *Forest watersheds, *Oregon, Watersheds(Basins), Streams, Streamflow, Erosion, Soil erosion, Forests, Forestry, Road construction, Roads, Clear-cutting, Forest management, Sediment transport, *Oregon Coast Range.

Suspended sediment production after road construction, logging, and slash disposal was significantly increased (P = 0.95) on two watersheds in Oregon's Coast Range. A 25% patch-cut watershed showed increases during 3 of 8 posttreatment years. These increases were caused primarily by mass soil erosion from roads. Monthly sediment concentrations before the occurrence of the annual peak flow were increased more than those following the annual peak. Surface erosion from a severe slash burn was the primary cause of increased sediment yields for 5 posttreatment years on a watershed that was 82% clear-cut. Monthly sediment concentrations were generally increased throughout the winter runoff period on this watershed. The flushing of suspended sediment in Oregon Coast Range watersheds is apparent from seasonal changes of suspended sediment rating curves. (Sims-ISWS)
W79-04750

ILLINOIS COASTAL ZONE MANAGEMENT PROGRAM, 2ND YEAR WORK PRODUCT. VOLUME II. COASTAL GEOLOGICAL STUDIES, HYDROGEOLOGIC, GEOLOGIC, AND ENGINEERING ASPECTS OF LAKE MICHIGAN SURFICIAL DEPOSITS,
Illinois State Dept. of Transportation, Chicago. Div. of Water Resources.
For primary bibliographic entry see Field 2F.
W79-04874

DEPOSITION OF NONUNIFORM SEDIMENT ON CONCAVE SLOPES,
Purdue Univ., Lagayette, IN. Dept. of Agricultural Engineering.
S. S. Davis, G. R. Foster, and L. F. Huggins.
Paper No. 78-2519, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 19 p. 8 fig, 4 tab, 20 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sediment transport, Simulation analysis, *Overland flow, Aggregates, Sands, Sediment yield, Homogeneity, Heterogeneity, Slopes, Watersheds(Basins).

A laboratory study was conducted to investigate behavior of simulated natural sediments transported and deposited by overland flow. Aggregate substitutes and sand were studied both as separate homogeneous sediments and as weight proportionally combined heterogeneous sediment mixtures. (Skogerboe-Colorado State)
W79-04917

DESIGN AND OPERATION OF GRADIENT TERRACE SYSTEMS,
Soil Conservation Service, Des Moines, IA.
D. T. Bondurant, and J. M. Laflen.
Paper No. 78-2520, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 7 p. 4 fig, 5 tab, 19 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Terracing, *Erosion control, Pollution abatement, Design criteria, Costs, Soil conservation, Water conservation, Sediment control.

Two types of gradient terraces were planned on each of two Iowa fields. Comparison shows that the type of terrace selected will have a major effect on cost of terracing and on farmer acceptance, but little effect on off-field water quality. (Skogerboe-Colorado State)
W79-04918

AN EROSION MODEL FOR ARID WILDLAND WATERSHEDS,
Utah State Univ., Logan. Dept. of Soil Science.
R. J. Wagenet, W. J. Grenney, and J. J. Jurinak.
Paper No 77-2510, Presented at the 1977 Winter Meeting of the American Society of Agricultural Engineers, December 14-17, 1977, Chicago, Illinois. 22 p, 6 fig, 2 tab, 6 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Computer models, Model studies, *Soil erosion, Sediments, *Heavy metals.

A non-site specific computer model was developed to predict environmental metal distribution resulting from the erosion of stack derived emissions of a coal fired electric generating facility. Model predictions of sediment eroded Zn, Cd, Cr, Pb, and Hg are presented for a 25 year period, and show Hg and Cd to be of environmental concern while indigenous soil levels of Zn, Cr, and Pb greatly outweigh contributions expected from the generating facility. (Skogerboe-Colorado State)
W79-04994

2K. Chemical Processes

SOURCES, LEVELS, AND REACTIONS OF BORON IN FLORIDA WATERS,
Florida Univ., Gainesville. Dept. Environmental Engineering Sciences.
N. E. Carriker, and P. L. Brezonik.
Journal of Environmental Quality, Vol. 7, No. 4, p 516-522, October-December 1978. 5 fig, 3 tab, 16 ref. OWRT A-024-FLA(2).

Descriptors: *Boron, *Photoxicity, *Sewage effluents, Florida, Rainfall chemistry, Water pollution sources, Detergents, Fertilizers, Sampling, Chemical analysis, Precipitation(Atmospheric), Municipal water, Surface waters.

Levels of boron in Florida natural waters are generally low (median value less than 50 micrograms/liter for 120 samples) and not of toxic concern. However, municipal sewage effluents have levels high enough (150-800 micrograms/liter) to cause phytotoxicity, at least to sensitive plants such as citrus. Detergent use of borate softeners and perborate bleaches is evidently the source the elevated boron levels in sewage. Boron concentrations in rainfall increase with proximity to either coast in peninsular Florida, reaching levels of 80-90 micrograms/liter. Marine aerosols, thus, are implicated as an important natural source in the boron cycle of Florida. Model ecosystem studies indicated little bioaccumulation and no toxic hazard at levels expected in natural waters. Interactions of boron with clays and with dissolved organic color (humates) were found to be small, and boron behaves as an essentially conservative element in natural waters. (Sims-ISWS)
W79-04603

CALCIUM-SUPPLYING CHARACTERISTICS OF TWO GYPSUM MATERIALS ON SOUTHEASTERN COASTAL PLAIN SOILS,
Texas A and M Univ., Overton. Agricultural Research and Extension Center.
For primary bibliographic entry see Field 2G.
W79-04662

FACTORS CONTROLLING THE ESTUARINE CHEMISTRY OF ARSENIC,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 2L.
W79-04728

THE CARBON ISOTOPE GEOCHEMISTRY OF A SMALL GROUNDWATER SYSTEM IN NORTHEASTERN ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
P. Fritz, E. J. Reardon, J. Barker, R. M. Brown, and J. A. Cherry.
Water Resources Research, Vol. 14, No. 6, p 1059-1067, December 1978. 5 fig, 5 tab, 23 ref. NRC A7954, A9170.

Descriptors: *Carbon radioisotopes, *Geochemistry, *Water table aquifers, *Canada, Carbon, Carbon dioxide, Carbonate rocks, Bacteria, Methane, On-site-data collections, Sampling, Hydrologic data, Groundwater movement, Piezometers, *Canadian shield, Fractionation, Carbon sources.

The carbon isotopic composition (13C and 14C) of the inorganic carbon dissolved in the waters of a small, largely unconfined aquifer in unconsolidated sediments on the Canadian Shield has been investigated. Three principal carbon sources are recognized: soil CO2, rock carbonate, and biogenic CO2. The average delta C value of the soil CO2 is close to -21.0 + or - 1.5%, and present-day 14C activities of the soil CO2 vary between 130 and 162% modern 14C. Very minor amounts (less than 1.0%) of carbonate minerals (delta 13C = 0.6 parts per thousand) are present within the aquifer and react with this soil CO2 to produce a dissolved inorganic carbon (DIC) with 14C activities which are as much as 50% below the initial activities of the soil CO2. The third carbon source, a biogenic CO2, could be detected only indirectly, and its presence is primarily deduced from the occurrence of methane in the deeper parts of these aquifers. The large isotope fractionation which occurs during bacterial coproduction of CO2 with this methane results, however, in a 13C-rich CO2, and thus a DIC with high delta 13C values. Values of delta 13C as high as +11 parts per thousand have been measured in groundwaters on the Canadian Shield. Since the origin of the destroyed organic matter is not yet known, no assessment of the importance of this CO2 for the 14C contents of the DIC is possible. (Visocky-ISWS)
W79-04746

SAMPLING AND CHEMICAL INTERPRETATION OF PRECIPITATION FOR MASS BALANCE STUDIES,
Colorado Univ., Boulder, Dept. of Environmental Population and Organismic Biology.
For primary bibliographic entry see Field 2B.
W79-04747

CARBONATE CHEMISTRY OF GROUNDWATER FROM TROPICAL TOWER KARST IN SOUTH THAILAND,
Hong Kong Univ. Dept. of Geography and Geology.

For primary bibliographic entry see Field 2F.
W79-04752

TRACE ELEMENTS IN THE SEDIMENTS OF THE BUFFALO RIVER, ARKANSAS,
Arkansas Univ., Fayetteville.
For primary bibliographic entry see Field 5A.
W79-04956

2L. Estuaries

SEDIMENTATION IN A 'HALF-TIDE' HARBOR, PART 1. SEDIMENTATION UNDER ICE-FREE CONDITIONS,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2J.
W79-04562

SEDIMENTATION IN A 'HALF-TIDE' HARBOR, PART 2. SEDIMENTATION DURING PERIODS OF ICE-COVER,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2J.
W79-04563

VERIFICATION OF AN ESTUARINE MODEL FOR APALACHICOLA BAY, FLORIDA,
Florida Univ., Gainesville. Dept. of Civil Engineering.
D. S. Graham, J. M. Hill, and B. A. Christensen.
In: Proc. Specialty Conf. on 'Verification of Mathematical and Physical Models in Hydraulic Engineering', ASCE, College Park, MD on August 9-11, 1978. 9 p, 8 fig, 7 ref. SG-04-7-158-44046.

Descriptors: *Estuaries, *Water quality, *Model studies, Hydrodynamics, *Apalachicola Bay(FL), Imagery, Landsat imagery, Florida, Estuarine models, Hydrodynamic models.

A research project at the Hydraulic Laboratory of the University of Florida involves linking appropriate basin run-off and estuarine models to quantitatively predict the transient effects of runoff emanating from upland basin activities, particularly forestry practices, upon the biology and water quality of Apalachicola Bay, FL. A promising method of gathering synoptic verification data is combining field investigations with Landsat imagery, preferably simultaneously. The data so gathered and estimated are instantaneous and therefore amenable for verification of so-called real-time water-quality and hydrodynamic numerical models. (NOAA)
W79-04582

TRANSPORT OF NUTRIENTS AND CARBON FROM THE NANAIMO RIVER TO ITS ESTUARY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
R. J. Naiman, and J. R. Sibert.
Limnology and Oceanography, Vol. 23, No. 6, p 1183-1193, November 1978. 7 fig, 2 tab, 33 ref.

Descriptors: *Rivers, *Estuaries, *Nutrients, *Carbon, On-site investigations, Coasts, Tidal waters, Mud flats, Tidal effects, Tides, Nitrogen, Nitrates, Phosphorus, Chlorophyll, Organic compounds, Sampling, Data processing, Analytical techniques, Water quality, Water chemistry, *Nanaimo River(British Columbia), *Vancouver Island.

Over an annual cycle, concentrations of inorganic nitrogen, phosphorus, and organic carbon were measured slightly upstream from the confluence of the Nanaimo River, British Columbia, and its estuary. Inorganic nitrogen and phosphorus concentrations in river water are low most of the year and may not be important in supplying these nutrients to the estuarine mudflat. Large amounts of dissolved organic carbon (DOC) and fine particulate organic carbon (FPOC) are exported from the river to the mudflat (about 2,000 and 56 gC/sq m/yr), but the actual amount retained and utilized by the mudflat community is not known. Comparison with in situ primary production on the mudflat showed that fluvial DOC may be the greatest source of carbon to the system. A conceptual hypothesis was presented which relates basin morphometry and retention structures to estuarine efficiency in retaining nutrient and carbon inputs. (Sims-ISWS)
W79-04726

SHELF FLUSHING RATES BASED ON THE DISTRIBUTION OF SALINITY AND FRESHWATER IN THE GEORGIA BIGHT,
Skidaway Inst. of Oceanography, Savannah, GA.
L. P. Atkinson, J. O. Blanton, and E. B. Haines.
Estuarine and Coastal Marine Science, Vol. 7, No. 5, p 465-472, November 1978. 4 fig, 12 ref, ERDA E(38-1)-889, NSF GA-27725.

Descriptors: *Continental shelf, *Sea water, *Freshwater, *Spatial distribution, *Georgia, *Atlantic Ocean, *Gulf Stream, Coasts, Salinity, Saline water-freshwater interfaces, Runoff, Oceans, Rivers, Water temperature, Oceaography, *Georgia Bight, Flushing rates.

Freshwater off the Georgia, South Carolina, and northeast Florida coast varies from 5 to 12 cu km, depending on the local runoff. The flushing rate calculated from the freshwater volume and river runoff rate is relatively invariant at 2.7 months. This invariance is thought to imply a constant flushing process, and it was postulated that Gulf Stream meanders and eddies are important in that process. A simplified calculation involving Gulf Stream meander frequency and typical entrainment dimensions produced a flushing rate of 2-3 months. (Sims-ISWS)
W79-04727

FACTORS CONTROLLING THE ESTUARINE CHEMISTRY OF ARSENIC,
Skidaway Inst. of Oceanography, Savannah, GA.
D. G. Waslenchuk, and H. L. Windom.
Estuarine and Coastal Marine Science, Vol. 7, No. 5, p 455-464, November 1978. 6 fig, 3 tab, 14 ref.

Descriptors: *Arsenic compounds, *Estuaries, *Georgia, Sampling, Rivers, Surveys, Water quality, Water pollution, Pollutants, Path of pollutants, Mixing, Salinity, Organic compounds, Sediments, Carbon, Water chemistry, Chemical reactions, Biochemistry, Coasts, Tidal waters.

Studies on several southeastern U.S. rivers revealed that arsenic is largely unreactive in the estuarine environment. Dissolved pentavalent arsenic, the only detectable species, behaves conservatively (within experimental accuracy) in the estuary as fresh and saline waters mix. Complexes occur between arsenic and low molecular weight dissolved organic matter. Unlike high molecular weight organics, the low molecular weight organic fraction passes conservatively through the estuary, carrying the complexed arsenic. These complexes presumably prevent adsorption and coprecipitative interactions between arsenate and flocculating iron hydroxides and humics. Arsenic which enters the estuary associated with particulates apparently remains so, and accumulates in the sediments. If post-depositional remobilization does occur, it has only a small, unmeasurable effect (less than 7%) on the dissolved arsenic concentration in the water column. The biota do influence the speciation of arsenic associated with estuarine suspended particulates however. A dimethylarsenic maximum at mid-estuary reflects biomethylation of inorganic arsenic. (Sims-ISWS)
W79-04728

EFFECT OF SALT UPON HOT-WATER DISPERSION IN WELL-MIXED ESTUARIES,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
R. Smith.
Estuarine and Coastal Marine Science, Vol. 7, No. 5, p 445-454, November 1978. 4 fig, 17 ref, 1 append.

Descriptors: *Dispersion, *Buoyancy, *Thermal pollution, *Model studies, Mathematical models, Numerical analysis, Water circulation, Mixing, Salinity, Salts, Discharge(Water), Powerplants, Cooling water, Estuaries.

Temperature and salinity variations both give rise to buoyancy-driven currents. Thus, when hot water is discharged into estuaries, the flow is changed both by the heat and by the induced perturbation of the salinity distribution. If cross-sectional mixing takes place in much less than the tidal period, then it can be shown that the salinity anomaly and the temperature distribution satisfy coupled nonlinear diffusion equations. For weak buoyancy effects, the interactions are such as to disperse heat preferentially inland. Quantitative estimates suggested that the asymmetry between inland and out-to-sea dispersion coefficients can be as much as 50%. (Sims-ISWS)
W79-04729

COMPARATIVE STUDY OF THE FIXATION OF INORGANIC MERCURY ON THE PRINCIPAL CLAY MINERALS AND THE SEDIMENTS OF THE LOIRE ESTUARY,
Nancy-1 Univ. (France). Lab. de Toxicologie.
M. Frenet-Robin, and F. Ottmann.
Estuarine and Coastal Marine Science, Vol. 7, No. 5, p 425-436, November 1978. 6 fig, 11 tab, 13 ref.

Descriptors: *Mercury, *Clays, *Laboratory tests, *On-site investigations, Adsorption, Salinity, Turbidity, Tidal waters, Water circulation, Water chemistry, Chemical analysis, Montmorillonite, Illite, Kaolinite, Sediments, Suspended solids, Pollutants, Water pollution, Pollutant identification, Rivers, Estuaries, *France, *Loire Estuary(France).

Samples of kaolinite, illite, and montmorillonites were agitated with solutions of mercuric chloride at different salinities, clay turbidities, and concentrations of mercuric ions. The rates of adsorption and maximum quantities adsorbed were obtained in terms of these factors. Clays with known quantities of adsorbed mercury were agitated with fresh and salt water to measure rates of desorption. The values obtained were compared with an analysis of the water and sediments of the Loire Estuary, based on a large number of samples taken over the period 1972-1975. Mercury pollution has decreased considerably over this period. (Sims-ISWS)
W79-04730

RECREATIONAL BOATING ON THE TIDAL WATERS OF MARYLAND. A MANAGEMENT STUDY.
For primary bibliographic entry see Field 6B.
W79-04876

DESIGN CONCEPTS FOR IN-WATER CONTAINMENT STRUCTURES FOR MARSH HABITAT DEVELOPMENT,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 5E.
W79-04925

MORPHOMETRY OF A TIDAL MOUTH, ACCORDING TO ITS DISCRETE MODEL,
V. A. Zholondz'.
Soviet Hydrology: Selected Papers, Vol. 16, No. 1, p 1-8, 1977. 2 fig, 1 append. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 232, p 24-37, 1977.

Descriptors: *Estuaries, *Geomorphology, *On-site investigations, *Model studies, Remote sensing, Aerial photography, Mathematical models, Computer models, Hydrometry, Rivers, Tidal waters, Tides, Tidal effects, Channels, Simulation analysis.

The major result of these investigations was proof that a combination of aerial photography (or some remote means of obtaining information), hydrometry, and the most modern methods of numerical

simulation using modern computers makes it possible to reproduce in natural size the dynamic objects of the earth in the form of volumetric or plane numerical coordinate models. The developed numerical model makes it possible to imitate a natural object in four-dimensional space with complete automation of the computation process and proof of the viability of the general method of constructing such models. The model makes it possible to compute such characteristics as area and volume with any preassigned accuracy, ensuring long storage of information over the investigation period and reception of cartometric and hydrometric data on the intermediate state of the object at the instant of time of interest to the researcher. The use of natural numerical simulation to study natural dynamic objects eliminates the need for expensive field investigations. (Sims-ISWS)
W79-04950

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

CONCEPTUAL DESIGN STUDY OF A ONE MILLION GALLON PER DAY MSM DESALINATION PLANT REPLACEMENT FOR DEMONSTRATION PLANT NO. 2 AT POINT LOMA, SAN DIEGO, CALIFORNIA.
The Fluor Corp. Ltd., Los Angeles, CA.
Available from Supt. of Documents, GPO, Washington, DC 20402. OSW Research and Development Progress Report No. 252, April 1967. 147 p, 28 fig, 6 tab. 14-01-0001-414.

Descriptors: *Desalination plants, *Desalination processes, *Facilities, Flash distillation, Equipment, Scaling, Design criteria, Capitol costs, Estimated costs, San Diego(California).

The development of a Title I conceptual design, including cost estimates, for a one million gallon/day sea water conversion plant is presented. The plant will incorporate equipment and facilities provided by the original plant which remain on the site. This equipment includes: the oil-fired package boiler with fuel oil unloading, storage, pumping and heating equipment; sea water intake system; cooling tower; and plant building and roads. The plant will employ the multistage-multieffect flash process developed for the large plant with an initial maximum brine temperature of 250F. The plant description consists of the process description, special design considerations, equipment descriptions, basic plant equipment lists, utilities, heat and material balance, Effect IA equipment list, and flow diagrams and drawings. The three scale control systems, slurry recycle, Lime-MagCarbonate, and fluidized resin are detailed. Capital cost estimates include costs for the basic plant, high temperature Effect IA, slurry recycle, fluidized resin and Lime-MagCarbonate. Applicable codes and standards are listed. (Davison-IPA)
W79-04511

FINAL THREE YEARS' PROGRESS ON STUDY AND FIELD EVALUATION OF SEA WATER STILLS.
Battelle Memorial Inst. Columbus, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-183 870, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 190, May 1966. 90 p, 46 fig, 7 tab, 24 ref. 14-01-0001-284.

Descriptors: *Solar distillation, *Solar stills, *Water conversion, *Desalination processes, Investigations, Desalination apparatus, Economics, Cost analysis, Estimated costs, On-site tests, Laboratory tests.

A study of the single-effect solar still aimed at reducing the cost of solar distilled water through finding ways to lower the costs of constructing, operating, and maintaining the still, and finding ways to increase still productivity is reported. Field testing, analytical studies, and laboratory still work were carried out. Field testing revealed that glass covered basin stills were the most satisfactory, and appear to be practical for application in some areas of the world. An economic study indicated that under some conditions solar could produce fresh water at a lower cost than other types of conversion procedures. Developments in plastic technology show a potential of making the air-inflated plastic covered stills more economical than the glass covered units. It is concluded that: the glass covered basin still is practical and durable; distilled water can be produced for about $3.00/thousand gallons in developing countries; this method is more economical than the vapor compression or flash distillation processes when 50,000 gallons/day or less is required; feed water should be filtered to eliminate the formation of slime growth in the still; the performance of a basin still can be predicted; and the economy of any contemplated installation can be assessed realistically. (Davison-IPA)
W79-04512

RESEARCH ON METHODS FOR SOLAR DISTILLATION,
New York Univ., NY. Engineering Research Div.
M. Telkes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 388, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 13, December 1956. 77 p, 17 fig, 12 tab, 5 ref, 1 append. 14-01-001-68.

Descriptors: *Solar distillation, *Solar stills, *Water conversion, *Desalination processes, *Economic evaluation, Investigations, Desalination apparatus, Water purification, Water treatment, Saline water, Cost comparisons, Heat transfer, Heat exchangers, Equipment.

An investigation into reducing the total cost of sustained conversion of sea, or other saine water to fresh water in large quantities, using solar energy, through developing new methods and improving existing methods is reported. Tilted flat type solar stills and roof-type stills were compared, and it was determined that the tilted stills yielded 26 to 50% more during the summer. The heat transfer calculations used for the comparison are presented and discussed. The construction of tilted flat stills is described. Experiments were performed using models of the flat tilted still, the 'standard' roof-type still, and a semi-roof type still constructed for the experiments; the results of these experiments are presented. Multiple effect solar stills, previously developed, were used with one and five stages on each side of the heat exchanger in laboratory experiments, and a ten stage multiple effect still was developed for tests made with sea water. The materials used in the multiple effect stills were economically evaluated, and it was concluded that a 10 stage solar still, costing three times as much as a single effect still, could produce six times more water. (Davison-IPA)
W79-04513

SECOND TWO YEARS' PROGRESS ON STUDY AND FIELD EVALUATION OF SOLAR SEA-WATER STILLS.
Battelle Memorial Inst., Columbus. OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-185 487, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 147, July 1965. 89 p, 70 fig, 10 tab. 14-01-0001-108.

Descriptors: *Water conversion, *Saline water, *Solar distillation, *Solar stills, Linings, Asphalt, Desalination processes, Wettability, Evaluation, Investigations, On-site investigations.

The evaluation and operation of solar stills which convert saline water to fresh water is reported. A deep-basin still, constructed to replace a still that was badly damaged during a 1960 hurricane, has performance characteristics approximately the same as the one it replaces. Although tilted wick stills are more difficult to operate and have shorter lives, they are more efficient than basin stills. Four vertical-envelope stills were unsatisfactory due to the poor wettability of their wicks and susceptibility to wind damage. The all plastic inflated-tube still performed successfully with productivity levels close to those of the basin stills. Butyl rubber sheeting, asphalt-impregnated-jute, and a prefabricated asphalt mat are being evaluated as basin liner materials. Asphalt paving leaked excessively when it was tried. New distillate trough materials, new glass-sealing methods, and single-strength glass covers are being investigated. Control methods investigated for the slime growth in the basins have been unsuccessful. (Davison-IPA)
W79-04514

DEVELOPMENT OF A THIN-LIQUID-FILM MEMBRANE UNIT FOR DESALINATION BY REVERSE OSMOSIS,
Dorr-Oliver, Inc., Stamford, CT.
D. S. Davies, and J. G. Canamare.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-197 789, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 420, June 1969. 100 p, 29 fig, 9 tab, 13 ref, 1 append. 14-01-0001-542.

Descriptors: *Desalination processes, *Desalination apparatus, Laboratory tests, Laminar flow, Membranes, Velocity, Reverse osmosis, Films, Design criteria, Water treatment, Water purification.

A study, conducted in two phases, to establish design criteria for units embodying the laminar flow, narrow channel principle, and to develop a 1000 gpd narrow channel device to demonstrate the validity of the narrow channel concept is reported. During Phase I, a test cell was constructed and successfully operated which permitted the characterization of desalination in a narrow channel under laminar flow conditions. Results showed that a velocity dependence exists, and low laminar flow velocity moduli were higher than predicted. Theoretical predictions were more closely duplicated by higher velocities. During Phase II, the laboratory study was expanded to a pilot scale. Testing was carried out principally on sea water having a salt content range of 25,000 to 30,000 ppm and operating at 1500 psi. Initial results of the program paralleled the laboratory work. Higher polarization values were obtained with low corresponding salt rejections. Higher moduli values at low feed velocity and moduli approaching the theoretical at high velocities was characteristic. Salt rejections gradually increased above that obtained by normal membrane consolidation. This was due to seal leakage from the high pressure feed side to the atmospheric pressure product channel. Resuls of both study phases show that the thin channel concept is valid and can be incorporated into practical large scale desalination devices, but thin channel design was not optimized. (Davison-IPA)
W79-04515

REVERSE OSMOSIS FOR WATER DESALINATION,
General Atomic Co., San Diego, CA.
U. Merton, H. R. Lonsdale, R. L. Riley, and K. D. Vos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-184 120, Price codes: A10 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 208, September 1966. 219 p, 36 fig, 57 tab, 94 ref. 14-01-0001-250.

Descriptors: *Reverse osmosis, *Membranes, *Permeability, *Membrane process, Thin films, Desalination processes, Water purification, Water treatment.

A study of reverse osmosis covered flow relationships, boundary-layer effects, theories of membrane transport, the properties of cellulose acetate

membranes, the preparation and properties of new membrane materials, and the economics of the reverse osmosis process. Because of their excellent behavior in reverse osmosis, cellulose acetate membranes are emphasized. The permeability of these membranes, the structure and method of formation of modified membranes, the variables affecting the lifetime of modified membranes, membrane compaction, and the preparation of thin films are examined in depth. A search for membrane materials as potential alternates for cellulose acetate was relatively successful. The current status of reverse osmosis research is assessed. (Davison-IPA)
W79-04516

DEVELOPMENT OF IMPROVED ION-SELECTIVE MEMBRANES FOR DESALTING WATER, PART I AND PART II,
Southern Research Inst., Birmingham, AL.
W. C. Sheehan, R. W. Ligett, and E. B. Dismukes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 086, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 202, August 1966. 109 p, 41 tab, 13 ref, 5 append. 14-01-0001-347 and 14-01-0001-508.

Descriptors: *Desalination processes, *Electrodialysis, *Membranes, *Anions, *Cations, *Membrane processes, Cellulose, Monomolecular films, Radiation, Gamma rays, Ion transport, Water quality, Water quality control parchment.

Research on the preparation and evaluation of experimental membranes for use in electrodialysis is reported. In Part I anion-selective membranes were prepared by grafting two types of basic monomers to cellophane base films with gamma radiation from cobalt-60 and then treating the grafted material with methyl iodide to quarternize the amine groups. The higher rates of salt diffusion permitted by these membranes can be improved by using cellophane film initially cross-linked with tris (1-aziridinyl) phosphine oxide (APO). Cation-selective cellophane having acceptable transference numbers, electrical resistances and difussion values were prepared by cross-linking cellophane film with APO, and grafting sodium styrene sulfonate onto the film with gamma radiation. In Part II parchment was investigated as an alternative substrate material. The data indicate that parchment is a better base film than cellophane, denitrated nitrocellulose, and cellulose diacetate because of its greater tearing strength. Anion-selective membranes with desirable transport properties capable of withstanding electrodialysis were produced by cross-linking parchment with APO, graft polymerizing 4-vinylpridine with gamma radiation, and quarternizing the grafted polymer. Cation-selective membranes with satisfactory initial properties and a tendency to deteriorate in ion selectivity during electrodialysis were prepared by cross-linking parchment with APO and graft polymerizing sodium styrene sulfonate. (Davison-IPA)
W79-04517

EVALUATION OF AN ELECTROCHEMICAL DESALINATION PROCESS FOR BRACKISH WATE,
Oklahoma Univ., Norman.
G. W. Reid, F. M. Townsend, E. H. Klehr, L. E. Streebin, and A. Hu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 911, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 498, December 1969. 65 p, 11 fig, 29 tab, 5 ref, 3 append. 14-01-0001-1454.

Descriptors: *Desalination, *Desalination processes, *Ion adsorption, *Desalination apparatus, Electrodes, Membranes, Membrane processes, Cation adsorption, Anion adsorption, Electrodialysis, Water purification, Water quality, Water quality control, Brackish water, Engineering, Hydraulics.

An engineering evaluation of the ion-adsorption process for the desalination of brackish water is reported. An ion-adsorption unit was made by modifying a commercial electrodialysis apparatus, the 'Stackpack' whereby the concentrating chambers were eliminated. Saline water was forced to flow through the tortuous path spacers between the anion and cation selective membranes of the diluting chambers, where it was desalinated when anions were absorbed onto the anion membranes and cations onto the cation membranes under direct current. After the membranes became saturated with their absorbed ions, the polarity of the electric current was reversed, and the ions desorbed into the water stream which was rejected to waste. Initial tests, run on a single pair of membranes using sodium chloride, were followed by tests on brackish water from the Washita River and a well in the Lake Thunderbird area. The number of membrane pairs was increased to three, and the testing continued to obtain factors for building a unit of any size. Based on these factors, it was predicted that 20 membrane pairs would yield 17.9 gallons/day of product water when used as an ion-adsorption process. The same unit, when used as an electrodialysis apparatus on the same water would yield over 500 gallons/day. Attempts to increase the performance level of the ion-adsorption process were unsuccessful. It is concluded that the ion-adsorption process is not economically competitive with the electrodialysis process. (Davison-IPA)
W79-04518

FIFTH ANNUAL REPORT, SALINE WATER CONVERSION PLANT NO. 1, FREEPORT, TEXAS.
Stearns-Roger Inc., Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-206 291, Price codes: A14 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 253, March 1967. 292 p, 67 fig, 38 tab, 6 ref, 1 ammend.

Descriptors: *Desalination plants, *Desalination processes, *Long-tube vertical distillation, *Desalation, Water purification, Mechanical equipment, Hydraulic machinery, Economics, Capital costs, Operating costs, Cost analysis, Cost comparisons, Evaluation, On-site investigations, Corrosion, Construction materials, Evaporation, Construction, Demonstration Plant No. 1.

A wide variety of information findings concerning the Long-Tube Vertical (LTV) multiple-effect evaporation method of desalination employed by Demonstration Plant No. 1, Freeport, Texas, is presented. The technical, logistical, and economic evaluations for Fiscal year 1966 operations are discussed in addition to the process and mechanical development program results as related to the LTV process in particular, and desalination in general. Capital and operating costs are compared to theoreti 'normalized' capital and operating costs. Production, economy ratios, costs averages, and maintenance problems are presented. A technical evaluation of the existing process, equipment, corrosion, and construction materials is included. The detailed process evaluation includes presently defined limitations of the temperatures, and construction ratios for scale-free operation of LTV evaporators without presoftening the feed water. Results of tests with newly installed equipment of advanced design are presented. Recommendations and findings of a study which resulted in the decision to extend the evaporation train to 17 effects and other major modifications are included along with conclusions, recommendations and proposals. A process flow diagram is provided. (Davison-IPA)
W79-04519

NEW SYNTHETIC MEMBRANES FOR REVERSE OSMOSIS DESALINATION,
Arthur D. Little Research Inst., Inveresk (Scotland).
A. Sharples, and G. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-182 535, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 329, October 1967. 66 p, 20 fig, 10 tab, 22 ref. 14-01-0001-741.

Descriptors: *Reverse osmosis, *Membranes, *Membrane processes, *Copolymers, Thin films, Desalination, Desalination processes, Water purification, Water treatment, Brackish water, Cellulose, Plastics.

The search for membranes with improved performance for use in the reverse osmosis process for water desalination is reported. Currently, the most successful membrane is cellulose acetate. The present study, in two parts, is concerned with the copolymer system based on methyl methacrylate coupled with a sugar containing monomer, 6-0-methacryloyl 2-D galactopyranose. Part 1 presents the preparation and characterization of thin homogeneous films. The detailed study of these films includes casting solvents, throughput and rejection characteristics, time-dependence of flow characteristics, and the effect of acids and alkalis. Part 2 presents the problem of casting these problems in a suitable asymetric form to obtain high throughput membranes suitable for use in a commercial process. Although it was demonstrated that these copolymers could be cast in high throughput form while retaining the characteristics of homogeneous membranes, the casting conditions were not optimized, and performance did not equal those of cellulose acetate membranes. These copolymer membranes are able to reject divalent ion salt when sodium chloride rejection is low. One membrane rejected 94% of magnesium sulfate while rejecting only 20% of sodium chloride, indicating potential use in brackish water purification. Alkali stability for copolymer membranes is greater than for cellulose acetate. (Davison-IPA)
W79-04520

DEVELOPMENT OF DIRECT CONTACT CONDENSATION MULTISTAGE FLASH DISTILLATION PROCESS: PHASE II,
Atomics International Div., Canago Park, CA.
A. L. Kohl, T. T. Shimazaki, J. R. Wetch, and W. B. Suratt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 588, Price codes: A08 in paper copy, A01 in microfiche. OSN Research and Development Progress Report No. 566, May 1970. 141 p, 39 fig, 23 tab, 19 ref, 4 append. 14-01-0001-2266.

Descriptors: *Flash distillation, *Condensation, Desalination, Heat exchangers, Plastics, Tedlar, Heat transfer, Costs.

A program continuing an investigation of techniques which increase the heat transfer coefficient and the condensation rate in the direct contact condensation unit is discussed. Four specific tasks were involved in the program. The 55 test runs made during the Direct Contact Condensation (DCC) Test provided data on the effects of water depth and flow rate, steam pressure and velocity, the presence of turbulance promotors in the water, and other variables. Plastic film heat exchanger testing demonstrated the practicability of fabricating tubes on a continuous basis using the process conceived during Phase I. Testing of the reference plastic film material (Tedlar) was continued, and simple screening and evaluation tests were conducted on other plastics which were potentially lower in cost. Only carbon loaded crosslinked polyethylene exhibited promise for temperatures in the 200F range. Less expensive than Tedlar, it showed good strength characteristics. Capital costs of large plants using the Atomic International (AI) DCC multistage flash distillation on (MSF) are potentially less than MSF or combined vertical tube evaporator (VTE) plants. However, the cost of water from the AI DCC MSF process is dependent on the plastic used in the heat exchanger, the assumed life of plastic tubes, and fixed charge rate. If cross-linked polyethylene tubes become applicable, the process would be more economical than the combined VTE or MSF. (Davison-IPA)
W79-04521

STRUCTURE AND PROPERTIES OF REVERSE OSMOSIS MEMBRANES,
Aerojet-General Corp., Azusa, CA.
B. Keilin, C.W. Saltonstall, W. S. Higley, R. E.

Kesting, and A. L. Vincent.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 081, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 154, November 1965. 75 p, 26 fig, 10 tab, 24 ref. 14-01-0001-338.

Descriptors: *Membrane processes, *Reverse osmosis, *Desalination, *Cellulose acetate, Mechanical properties, Structure, Kinetics, Evaluation, Separation techniques, Strength, Pressure, Osmotic pressure, Water quality control, Desalination apparatus, Semipermeable membranes, Desalination processes, Water purification, Water treatment.

A study of the fundamental aspects of cellulose acetate membrane preparation, structure, and properties is reported. Major attention was given to quantitative measurements for transport mechanism and for membrane structure studies. Transport studies were concerned with clarifying the detailed mechanism of desalination by reverse osmosis through the measurement of process kinetics. In membrane structure studies, the relationship between preparative variables and mechanical properties of the membranes were evaluated, and an effort was made to correlate changes in osmotic properties with mechanical properties. An investigation of gel structure through light-scattering measurements on membrane casting solutions was undertaken. Major accomplishments over the past year in the following areas are examined: (1) activation energy in salt and water transport; (2) feed additives; (3) tensile properties; (4) compression properties; and (5) light-scattering measurements. (Davison-IPA)
W79-04664

REVERSE OSMOSIS MEMBRANES CONTAINING GRAPHITIC OXIDE,
Westinghouse Research Labs, Pittsburgh, PA.
L. C. Flowers, D. E. Sestrich, and D. Berg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-196 117, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 224, December 1966. 81 p, 17 fig, 16 tab, 50 ref. 14-01-0001-550.

Descriptors: *Desalination, *Graphitic oxide, *Desalination processes, *Reverse osmosis, *Membranes, Membrane processes, Semipermeable membranes, Pressure, Osmotic pressure, Desalination apparatus, Chemical analysis, Physical properties, Films, Fabrication, Organic compounds, Polymers.

Graphitic oxide (GO) sols were prepared and examined chemically and physically as first steps in determining whether GO could be used as membranes in the reverse osmosis process of desalination. Membrane fabrication techniques included: 'free films', obtained by air drying GO suspensions; 'suction filtering'; and pressure filtration. Of these, pressure filtration proved to be the most successful. Various porous supporting bases were tested separately under the same conditions the actual GO membranes undergo during reverse osmosis testing. The possibility of combining GO with organic polymers as binders in fabricating membranes was considered, and several bindes were prepared. Most were stored for future use, and only one, 150-minute CEPVA containing 6.6% nitrogen, was actually used. The reverse osmosis testing apparatus and experimental data are discussed, including membrane performance. It is concluded that GO membranes exhibit the essential properties characteristic of desalination membranes, but their water flux rates and salt rejection capabilities are lower that those for cellulose acetate. The study of GO membrane functions regarding reverse osmosis desalination is not sufficiently advanced to warrant a conclusive theory concerning their mechanism. (Davison-IPA)
W79-04665

THE MECHANISM OF MASS TRANSFER THROUGH A LIQUID INTERFACE,
Midwest Research Inst., Kansas City, MO.
A. E. Vandegrift.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-196 118, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 226, December 1966. 46 p, 46 fig, 2 tab, 4 ref, 2 append. 14-01-0001-656.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Surface tension, *Mass transfer, Diffusion, Membrane processes, Interfaces, Saline-freshwater interfaces, Laboratory equipment, Laboratory tests, Water purification, Evaporation, Ammonia, Alcohols.

The oscillating jet method for dynamic surface tension was used to determine whether the presence of salt increased the interface resistance to mass transfer. Studies of the absorption of ammonia and ethyl alcohol into distilled water and salt water resulted in general information about the effect of dissolved salt on interface resistance, which may be applied to the evaporation of salt water. The technique used allowed the acquisition of the surface tension of a solution as it changed with time due to changes in the surface concentration or chemical potential. It is concluded that the addition of salt to distilled water does not increase interface resistance to mass transfer within the accuracy of this experimental method; theory and experiment do not agree on the rate of ammonia absorption; theory and experiment agree completely as to the adsorption of ethyl alcohol. The oscillating jet for gas absorption studies has proven feasible, so that it should be possible to obtain much fundamental information about the action of interface during mass transfer. (Davison-IPA)
W79-04666

DEVELOPMENT OF AN ANALYTICAL METHOD FOR MEASURING THE HYDROCARBON CONTENT IN WATER,
Koppers Co., Inc., Pittsburgh, PA.
M. A. Phillips, W. R. Holden, E. W. Albaugh, W. E. McKinstry, and H. A. Sweeney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 253, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 115, November 1964. 70 p, 28 fig, 17 tab, 34 ref, 2 append. 14-01-001 204 and 14-01-0001-344.

Descriptors: *Desalination, *Analytical techniques, *Instrumentation, *Prototype tests, Prototypes, Potable water, Effluents, Saline water, Organic compounds, Ionization, Chemical analysis, Water purification, Brines, Calibrations, Desalination plants.

The development of an analytical method designed to measure the hydrocarbon content in potable water and reject brine streams emerging from saline water conversion pilot plants at the Research and Development Test Station, Wrightsville Beach, North Carolina is described. A prototype analytical hydrogen flame ionization detection unit was designed as the result of experimental work on developing this method. This prototype was used as a basis for the design of the hydrocarbon analyzer, which was constructed and installed in the Munroeville Research Center, after calibration for n-butane ranging from 0.05 to 2.0 ppm by weight in water. The following features of the analyzer were not included in the prototype: (1) compact installation in a console; (2) timing devices which permit automotive sampling and variation of the sampling time; (3) the recorder chart drive operates during the automatic or manual sampling periods only; (4) enclosure of the stripping unit and associated water lines within the console; and (5) provision for the introduction of a standard reference gas to the sampling system for checking the instrument calibration. It is concluded that the gas stripping unit has been found suitable for its proposed applications. (Davison-IPA)
W79-04667

BIBLIOGRAPHY OF THE LITERATURE ON DROPWISE CONDENSATION, 1930-64,
Franklin Inst., Philadelphia, PA.
R. A. Erb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 269, Price codes: A02 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 119, August 1964. 14 p. 14-01-0001-293.

Descriptors: *Bibliographies, *Publications, *Dropwise condensation, *Condensation, *Desalination, Desalination processes, Distillation, Heat transfer, Saline water, Water treatment, Separation techniques, Steam, Heat transfer.

A compilation of references available in published literature directly concerned with dropwise condensation is presented. The publications are listed chronologically by year, and when two or more publications are listed for any year they are arranged alphabetically according to author. The letter in front of each entry classifies the emphasis in each document as follows: A emphasizes the mechanism of dropwise condensation; B emphasizes promoters for dropwise condensation; B emphasizes promoters for dropwise condensation; and C emphasizes heat transfer, or that the document is of a general nature. (Davison-IPA)
W79-04669

HEAT TRANSFER IN THE LIQUID-LIQUID SPRAY TOWER,
Dynatech Corp., Cambridge, MA.
S. P. Sukhatme, and M. Hurwitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-116 315, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 120, October 1964. 55 p, 15 fig, 16 ref, 2 append. 14-01-0001-382.

Descriptors: *Desalination, *Desalination apparatus, *Spray tower, *Heat exchangers, Heat transfer, Correlation analysis, Laboratory tests, Flow, Dispersion, Electric current, Electrical equipment, Liquids, Oil-water interfaces, Mixing.

A study of the heat transfer performance of a spray tower which uses water and AMSCO oil, and the possible augmentation of the performance with electrohydrodynamic (EMD) means by reducing the drop size is reported. A spray tower is a special type of heat exchanger in which two countercurrent liquids are in direct contact instead of flowing through separate channels. The fluid flow and heat transfer inside a spray tower is analyzed, and the experimental loop built for determining the heat transfer correlations in a 3-in diameter spray tower is described. Tests conducted with both water and oil dispersed (with the water heated by the oil), show that the satisfactory operation of a spray tower requires the formation of uniformly sized drops at the distributor plate, so that there is no coalescence. It was also shown that the tower may be stably operated in a flooded state if a simple end design is used on the spray tower. The heat transfer results with water dispersed in oil indicate that it is advantageous to operate the tower in a flooded state; not enough data was obtained with oil dispersed in water to make a definite conclusion. The use of EHD techniques in spray towers is not recommended because of the nonuniformity of drop size produced at high voltages. (Davison-IPA)
W79-04670

THE KOPPERS HYDRATE PROCESS FOR SALINE WATER CONVERSION EXPERIMENTAL AND ENGINEERING STUDIES,
Koppers Co., Inc., Pittsburgh, PA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 577, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 90, March 1964. 114 p, 50 fig, 3 tab, 32 ref, 1 append. 14-01-0001-204.

Descriptors: *Desalination, *Desalination processes, *Kopper Hydrate Process, Chemical precipitation, Filtration, Hydrates, Hydrate processes, Saline water systems, Crystallization, Separation techniques, Laboratory tests, Sea water, Sands, Potable water.

Laboratory work was performed to establish the technical and economic feasibility of the Koppers Hydrate Process as a means of desalinating sea water. This process is a chemical process, whereby a hydrating agent, such as propane or dichlorodifluoro-methane, and water combine to form insoluble crystals. The crystals, filtered from mother liquor, are washed free, and decomposed into salt free water and the liquid hydrating agent which is recycled. The work was carried out on bench-scale equipment, which included a 10-gallon reactor crystallizer with a capacity equivalent to 150 gallons of potable water/24 hours. Synthetic sea water and various hydrating agents, particularly propane, were used to prove the technical feasibility of the process. Filtration studies showed that it was possible to wash the crystals sufficiently free of brine, so that upon decomposition by contact with hot vapors of the agent, potable water can be produced. Filtering and washing equipment were evaluated through batch filtration and washing experiments using various hydrate crystals and sand. Consistant results were obtained with sand and hydrate crystals through a 12-in square filter at varying bed depths. The flexibility of this process, as related to the physical properties of the hydrating agents and the temperature and pressure chosen for any particular agent, offers possibilities for cost reductions. It is concluded that this process will develop into an economically attractive desalination process. (Davison-IPA)
W79-04671

MECHANISM OF ELECTRODE DEMINERALIZATION,
Rockwell International, Canoga Park, CA. Rocketdyne Div.
J. Farrar, S. Evans, and G. D. Seele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 404, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 126, January 1965. 44 p, 19 fig, 7 tab, 4 ref. 14-01-0001-334.

Descriptors: *Desalination, *Desalination processes, *Demineralization, *Electrolysis, Electrodes, Desalination apparatus, Electrochemistry, Electrodialysis, Ions, Water quality control, Separation techniques, Adsorption, Laboratory equipment, Electric currents.

Demineralization electrodes were studied in half cells to characterize, electro-chemically, the individual electrodes, and in complete cells to determine overall polarization and exchange characteristics. A three electrode system was used in the half cell studies, and the potential of the test electrode was measured with respect to a reference electrode. Coulometric and potentiostatic techniques were used. The electrodes studied were a (1) Dacron felt impregnated with carbon, and (2) an aqueous paste of carbon or graphite. Polarization data, determined using steady state techniques, voltammetry at linearly changing potentials, and chronopotentiometry, indicated no evidence for redox processes below potentials corresponding to the decomposition of water. The results of complete cell coulometric experiments show a correlation between current passed and uptake or release of ions. For all experiments, the average exchange efficiency was 25%. The exchange efficiency seems to be relatively independent of the number of coulombs passed, and very dependent on factors such as calendering, abrasion of graphite backing, and previous use of the electrodes. The demineralization process is not limited by transport to one or both of the electrodes. current reversal caused a regeneration of the salt concentration in the solution. When the potential was removed from the demineralization cell, the potential decreased, and ions were transferred back into solution, inferring an electrically induced physical adsorption. (Davison-IPA)
W79-04672

NUCLEATION AND GROWTH OF ICE CRYSTALS,
Rockwell International, Canoga Park, CA. Rocketdyne Div.
J. Farrar, and W. W. Hamilton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 405, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 127, January 1965. 57 p, 11 fig, 6 tab, 47 ref, 1 append. 14-01-0001-333.

Descriptors: *Desalination, *Desalination processes, *Nucleation, *Crystal growth, Ice-water interfaces, Saline water, Supercooling, Freezing, Water cooling, Crystallization, Water purification, Boundaries, Interfaces, Growth rates, Free energy.

Background information on nucleation in supercooled water and ice crystal growth are presented in a study of two different aspects of ice formation: (1) growth of ice crystals, and (2) supercooling of water and nucleation of ice. The rate of crystal growth was studied as a function of the temperature, salt concentration, liquid flow velocity, and additives. It was found that crystal growth velocities were different along the two major axis. This anistrophism is more apparent in saline solutions, along the two major axis. This anistrophism is more apparent in saline solutions, and can account for difficulties in freezing operations. Growth along the A-axis is unaffected by salt or additives, and is largely under thermal control, while growth along the C-axis is strongly inhibited by salts and additives. Raw sea water did not nucleate easily. Some droplets could be cooled below-23.5C without freezing. Larger masses of sea water, when stirred, required less supercooling. The free energy of ice water interfaces is important in ice nucleation and crystal growth. Data from this study were analyzed and correlated with physical constants in mathematical models. (Davison-IPA)
W79-04673

WASHING OF BRINE FROM ICE CRYSTALS,
Massachusetts Inst. of Technology, Cambridge.
J. P. Leinroth, Jr., W. P. White, T. K. Sherwood, and P. L. T. Brian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 401, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 128, January 1965. 82 p, 61 fig, 3 tab, 17 ref, 2 append. 14-01-0001-295.

Descriptors: *Desalination, *Desalination, *Desalination processes, *Freezing, *Ice washing, Separation techniques, Brines, Saline waters, Ice-brine systems, Slush, Crystals, Water treatment, Particle size, Particle shape.

The results of an experimental and theoretical study of the removal of brine from ice-brine slush by countercurrent washing are presented. Two separate investigations were performed: (1) the washing of brine from plastic and glass beads, which permitted investigation of the basic factors involved without the complications due to freezing and melting of ice; and (2) the batch washing of brine from a mass of small ice crystals. The data are analyzed in terms of a longitudinal-dispersion model which describes the blending of water and brine at the moving wash-water front. The results support the validity of the model as a basis for correlating and interpreting ice washing data. The least loss of water occurs if long columns are used without agitation of the bed. Washing performance, more effective in flooded than in drained beds, improves as the wash rate is reduced. The wash rates operable without ice entrainment in the brine effluent decrease as the size of the particles is decreased. Because brine readily drains from beds containing large particles, it may pove both practical and desirable to produce large ice particles and drain the brine before washing with piston-flow of wash water. (Davison-IPA)
W79-04674

A STUDY OF MEMBRANES FOR DESALINATION BY REVERSE OSMOSIS,
Aerojet-General Corp., Azusa, CA.
C. W. Saltonstall, Jr., F. C. Burnett, W. S. Higley, W. M. King, and A. L. Vincent.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-190 061, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 232, January 1967. 80 p, 29 fig, 8 tab, 25 ref. 14-01-0001-338.

Descriptors: *Desalination, *Desalination processes, *Membranes, *Membrane processes, *Reverse osmosis, Physical properties, Movement, Kinetics, Semipermeable membranes, Mechanical properties, Cellulose acetate, Polymers, Heat treatment, Permeability, Anions, Electrical resistance, Water treatment.

Accomplishments during 1966 on reverse osmosis membrane research are reported. Measurements on the active layer of reverse osmosis membranes are emphasized as part of a program to determine the relationship between osmotic properties and aspects of casting solution and membrane structure. A detailed investigation of the change in active layer properties during the annealing stage of its formation was performed, and an electrical conductivity technique for determining the permeability of the active layer was developed. Measurements made on swollen cellulose acetate membranes show that only the active layer offers significant electrical resistance. Studies show that heat treatment of swollen membranes is a two-step process. The initial rapid step is short, wherein most changes in osmotic properties and water content occur; in the second step, further changes occur at a greatly reduced rate. Membranes heat treated at 85C allowed 1.6% permeation of sodium chloride and only 0.16% calcium chloride permeation. An investigation of the kinetics of transport across cellulose acetate membranes has shown that the activation energy of water transport is independent of pressure and feed solution type and concentration. It was also shown that the anion of a solute is the most important species in determining solute permeation. Decreases in the compressive yield point of a cellulose acetate membrane resulted from decreased strain rates in the compression on measurements. (Davison-IPA)
W79-04675

USE OF WASTE HEAT FOR PRODUCTION OF FRESH WATER,
Burns and Roe, Inc., Oradell, NJ.
H. Gitterman, and S. Zwickler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-196 119, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 235, December 1966. 83 p, 21 fig, 12 tab, 32 ref. 14-01-0001-683.

Descriptors: *Desalination, *Desalination plants, *Industrial wastes, Gases, Liquid wastes, Energy, Energy conversion, Incineration, Wastes, Economics, Costs, Comparative costs, Water rates, Water supply, Water purification, Water treatment.

The economic advantages of using waste heat to provide the necessary energy and/or power to produce fresh water is evaluated. Waste heat is heat generated in excess of process requirements which is discharged to the surroundings as high temperature liquid, vapor, or gas. In industrial operations practicing recovery of waste heat, the practice has proven to be economical. For example, the generated gas of sewage plants is utilized to provide power directly by driving prime movers to satisfy inplant requirements. A survey was made of industries having waste heat available, and these sources were located geographically to determine the availability of waste heat near raw water sources and population centers. These waste heat souces include: refuse incineration, sewage incineration, cement plants, glass furnaces, foundries, industrial incinerators, and other industrial sources. The water sources, groundwater, surface water, and sea water, are also located geographically, and the solids in some typical surface water supplies are tabulated. The cost of available fresh water is discussed in comparison with the cost of desalinated water. It is indicated that the use of waste heat as an energy source for desalination plants may bring the cost of the product to a level competitive with other water supplies. Water costs

in U.S. communities are tabulated. Desalinated water costs using waste heat to supply energy were calculated and tabulated. (Davison-IPA)
W79-04676

CORROSION TEST PROGRAM,
Rice (Cyrus Wm.) and Co., Pittsburgh, PA.
W. F. Dietrich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-192 496, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 244, February 1967. 147 p, 17 fig, 12 tab, 60 ref, 1 append. 14-01-0001-768.

Descriptors: *Corrosion, *Desalination, *Desalination plants, *Saline water, *Construction materials, Evaluation, Data collections, Chemical properties, Chemical reactions, Dissolved oxygen, Distillation, Saline water, Temperature, Laboratory tests, Desalination processes, Potable water.

The information and data concerning corrosion which existed or resulted from the operation of the various desalination demonstration plants has been compiled and evaluated. The work also includes a compilation of: (1) an evaluated list of construction materials; (2) requirements for additional in-plant studies of construction materials; and (3) requirements for additional laboratory or pilot plant studies of construction materials. Test programs designed to provide data for the evaluation of construction materials, which come in contact with saline water, product water, and potable water as a blend of municipal water with product water, are presented. This study was accomplished through a literature search, site visits, and interviews with industry representatives having interest in saline water conversion efforts. It was found that the high temperature distillation type process has experienced the most harmful effects of corrosion; membrane and freezing type processes have been relatively unaffected. This work emphasizes the high temperature distillation processes. The variables, pH, the dissolved oxygen content in the saline water, and temperature are considered regarding corrosion. Dissolved oxygen, the most difficult variable to control, is theoretically most closely associated with corrosion. Background information on the various demonstration plants is provided; theoretical concepts of the electrochemical nature of corrosion are reviewed; laboratory and field methods of corrosion control are described; and conclusions and recommendations are presented. (Davison-IPA)
W79-04677

SECOND REPORT ON FABRICATION AND EVALUATION OF NEW ULTRATHIN REVERSE OSMOSIS MEMBRANES,
Midwest Research Inst., Minnetonka, MN. North Star Div.
P. S. Francis, and J. E. Cadotte.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-182 881, Price codes: A04 in paper copy, A01 in microfiche. OSW Final Research and Development Progress Report No. 247, April 1967. 65 p, 8 fig, 17 tab, 11 ref, 1 append. 14-01-0001-457.

Descriptors: *Desalination, *Reverse osmosis, *Thin films, *Polymers, Organic compounds, Membrane processes, Membranes, Semipermeable membranes, Mass transfer, Structure, Cellulose, Desalination apparatus, Desalination processes, Materials testing, Research and development, Water purification, Water quality control, Flow rates, Separation techniques.

A new class of high-performance desalination polymers resulted from a study of the desalination properties of cellulose acetate as affected by their polymer structure. Acetates of other polysaccharides, widely divergent in structure, were prepared and tested in reverse osmosis. All gave good salt rejection, and were within the same order of magnitude in water flux. Mixtures of these acetates, such as a 1:1 mixture of cellulose triacetate and xylan acetate gave basically the same desalination properties. It is indicated that polymer structure and form are minor factors for water transport by cellulose acetate. Xylan acetate and Beta-glucan acetate gave higher water flux than cellulose triacetate. The effects of the cellulose substituents were determined by preparing an ultrathin membrane from the desired cellulose derivative, and evaluating it for reverse osmosis. These derivatives were made by direct substitution of cellulose or by using a cellulose diacetate or dimethyl cellulose and substituting the remaining hydroxyl groups with the desired groups. It is concluded that: (1) cellulose triacetate gave very favorable desalination results as an ultrathin membrane; (2) addition of substituents with any alkyl group larger than one carbon atom always decreased the promoting water transport are those containing several oxygen, nitrogen or sulfur atoms closely grouped; and (4) cellulose methyl ethers show similar water transport rates to cellulose acetate. (Davison-IPA)
W79-04678

PERMEABILITY REQUIREMENTS OF MEMBRANES FOR USE IN DESALINATION BY REVERSE OSMOSIS,
Office of Water Research and Technology, Washington, DC. Biosciences Div.
H. E. Podall.
OSW Research and Development Progress Report No. 255, July 1967. 45 p, 13 fig, 4 tab, 13 ref.

Descriptors: *Membranes, *Reverse osmosis, *Desalination apparatus, Water treatment, Water treatment, Water purification, Permeability, Water properties, Diffusion.

The intrinsic permeability requirements of membranes to be used in the reverse osmosis process of desalination are quantitatively defined in terms of basic process parameters. These parameters include the initial feed concentration, required salt rejection efficiency, water product flux, volume percent water recovery, and the applied pressure. A simple diffusion model for calculating the water and salt fluxes was used to calculate the permselectivity and intrinsic water permeability of the membrane regarding the basic parameters. It was assumed that the fluxes were uncoupled or independent of each other. Examples of the requirements for three given feed concentrations under various process conditions are tabulated. (Davison-IPA)
W79-04679

INVESTIGATION OF THE REMOVAL OF TRACE TOXIC HEAVY METAL IONS FROM WASTE WATER BY FOAM FRACTIONATION,
Polytechnic Inst. of New York, Brooklyn. Dept. of Chemistry.
For primary bibliographic entry see Field 5D.
W79-04754

WATER PURIFICATION BY REVERSE OSMOSIS,
Ocean Water Ltd., Nassau (Bahamas). (Assignee).
L. P. S. Wilson.
U.S. Patent No. 4,124,488, 11 p, 7 fig, 15 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 232-233, November 7, 1978.

Descriptors: *Patents, *Desalination, *Water treatment, *Water purification, Reverse osmosis, Membrane processes, Pressure, Pistons, Desalination apparatus.

An apparatus for reverse osmosis purification of water or other fluid by passing the fluid under pressure across a membrane, through which membrane a part of the fluid passes in purified form, makes use of a piston or diaphragm pump in which the front face of the piston or diaphragm is used to force the fluid from one end of a cylinder into the module and in which the return fluid is applied to the rear face of the piston or diaphragm so that the pressures on the two faces are substantially balanced. The piston of diaphragm is operated by a piston rod attached to the rear face of the piston or diaphragm. The system is self-regulating to give an extraction ratio equal to the ratio of piston rod area to piston area. (Sinha-OEIS)
W79-04887

REVERSE OSMOSIS DESALINATION APPARATUS AND METHOD,
J. W. Chenoweth.
U.S. Patent No. 4,125,463, 8 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 976, No 2, p 566, November 14, 1979.

Descriptors: *Patents, *Desalination, *Reverse osmosis, *Desalination apparatus, Water purification, Water treatment, Saline water, Membrane processes, Hydrostatic pressure, Separation techniques.

A reverse osmosis desalination system and its method of operation is disclosed which takes advantage of the hydrostatic head of salt water for providing the differential pressures necessary for osmotic separation. The first step is drilling a well to a predetermined depth in a conventional manner. A casing member is instaled in the well hole and a smaller conductor member is placed within the casing, leaving an annular space. Attached to the lower end of the conductor member is a permeator assembly which may include one or more units having osmotic membranes responsive to predetermined differential pressures for separating salt water into salt free water and concentrated salt water. The depth of the well and the depth at which the permeator assembly is placed is such that the static head of salt water in the annular space between the casing and conductor members is great enough to create the necessary differential pressure for effecting the necessary osmotic separation. A tubular production member is placed within the well with a pump attached to the lower end for pumping the salt-free water to the surface of the well. The concentrated salt water is allowed to exit the well through the conductor member. (Sinha-OEIS)
W79-04898

STUDY OF MULTI-PHASE EJECTORS FOR FREEZING PROCESS DESALINATION SYSTEMS,
Kaye (Joseph) and Co., Inc., Cambridge, MA.
C. A. Kemper, G. F. Harper, S. W. Gouse, and J. H. Leigh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 256, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 118, May 1964. 56 p, 13 fig, 12 ref, 3 append. 14-01-0001-373.

Descriptors: *Desalination, *Flash distillation, *Ice-brine systems, *Multiple-Phase Ejector desalination systems, *Desalination processes, Flash freezing, Evaporators, Equipment, Saline water, Sea water, Water purification, Water treatment, Water quality, Water quality control, Freezing.

The results of a theoretical study of the direct contact freezing process and the flash evaporation freezing process in Multiple-Phase Ejector (MPE) desalination systems are reported. Both systems had two refrigeration cycles using normal-butane as a refrigerant. The low temperature cycle carries out the freezing process, and the high temperauture cycle rejects losses and work-inputs as heat to the environment. To compare the results from the study with published data on conventional systems, a single freezer temperataure of 25F was selected. The effects of ice-brine separator efficiency, pump efficiencies, viscous friction, and irreversible mixing processes in the MPE are considered. In establishing a baseline, an ideal reversible freezing process desalination system was compared to the ideal direct contact freezing MPE desalination systems. The results indicate work-input of: 2.56 Btu/16m of fresh water for the ideal direct contact system and 2.29 Btu/lbm of fresh water for the ideal reversible freezing system. It is concluded that increasing the size of the MPE mixing section improves the performance. (Davison-IPA)
W79-04935

THE ZONE-PURIFICATION PROCESS AS A METHOD OF PREPARATION OF POTABLE WATER FROM SEA WATER,
Battelle Memorial Inst., Columbus, OH.
S. E. Miller, R. C. Himes, and H. L. Goering.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 392, Price codes: A02 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 17, January 1958. 15 p, 2 fig, 1 tab. 14-01-001-80.

Descriptors: *Desalination, *Desalination processes, *Zone freezing, Freezing, Water purification, Potable water, Crystal growth, Crystallization, Demineralization, Ice-water interfaces, Sea water, Saline water, Water properties, Water treatment, Water quality, Water quality control.

A study to determine the feasibility of zone freezing for the purification of saline water is reported. A refrigeration and freezing apparatus was devised whereby continuous, direct visual observations of the freezing system were possible. Dye introduced into the sodium chloride solution facilitated the visual observation of the progress of directional freezing. Microscopic and analytical studies of the nature of ice laid down from salt solutions at various rates and concentrations, and under varying degrees of agitation revealed that good clear ice may be crystallized at reasonable high rates from dilute solutions, but the rate at which the ice crystals are grown is suppressed as solution concentration is increased. Trapping of salt in the solid mass occurs when the natural crystallization rate is exceeded, or when continued growth of the individual crystallites encroach upon one another. It is concluded that the shape of the solid-liquid interface, and natural crystallization rates at various solution concentrations are important factors in determining segregation efficiencies. With a single directional freeze it was possible to regularly remove more than 99.9% of salt from solutions containing up to 20 grams of salt/liter. In solutions containing 20 to 30 grams/liter 97.5% removals were effected, and in solutions containing 30 to 70 grams/liter, 82% removal was made. Potable water containing less than 50 ppm total salt concentration was produced from a two-stage program in directional freezing experiments on sea water. (Davison-IPA)
W79-04936

WATER AND ION FLOW THROUGH IMPERFECT OSMOTIC MEMBRANES,
Florida Univ., Gainesville. Dept. of Chemistry.
E. J. Breton, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 391, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 16, April 1957. 73 p, 26 fig, 3 tab, 44 ref, 1 append. 14-01-001-79.

Descriptors: *Semipermeable membranes, *Cellulose acetate, *Reverse osmosis, *Desalination apparatus, Osmotic pressure, Osmosis, Chemical reactions, Membrane processes, X-ray diffraction, Saline water, Laboratory tests, Water purification, Ions, Ion transport, Diffusion, Electrolysis.

To explain the behavior of cellulose acetate as a semipermeable membrane in saline water, several hypotheses concerning two different mechanisms for the transfer of water through these membranes were formulated. The most important evidence supporting the hypotheses was obtained from resistance experiments, wherein the resistance of specific ions was measured across cellulose acetate at various pressures. The resulting resistance-pressure relationship are correlated with the semipermeability of the cellulose acetate. X-ray diffraction and birefringence measurements were used to show the extensive structural changes, due to a chemical reaction between the solute and cellulose acetate, which occurs when the film ceases to behave as a semipermeable membrane. Specific recommendations for an improved semipermeable membrane are presented. A literature review, semipermeable tests, and the theory for the semi-permeability of cellulose acetate are examined. (Davison-IPA)
W79-04937

STUDY OF THE APPLICABILITY OF COMBINING NUCLEAR REACTORS WITH SALINE WATER DISTILLATION PROCESSES,
Fluor Corp., Whittier, CA.
D. B. Brice, M. R. Dusabek, and C. R. Townsend.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 062, Price codes: A10 in paper copy, A01 in microfiche. OSW Final Research and Development Progress Report No. 19. 219 p, 29 fig, 55 tab, 19 ref, 8 append. 14-01-001-97.

Descriptors: *Desalination processes, *Nuclear reactors, *Desalination plants, *Distillation, *Evaporators, *Operating costs, *Capital costs, Long-tube vertical distillation, Sea water, Vapor compression distillation, Water purification, Water treatment, Water quality control, Nuclear energy, Steam, Condensation.

A detailed economic and technical analysis of the heavy-water moderated and cooled reactor, and a technical analysis of a combination multiple-effect and multi-stage flash evaporator system are presented in the first part of this report. A discussion of the nuclear steam generating system includes descriptions of the nuclear reactor and its performance. Operating costs and reactor capital charges are examined, and include fuel element fabrication and reprocessing costs, uranium depletion and plutonium credit, and inventory charges. Costs of water from a combination long-tube vertical multiple-effect and multi-stage evaporator system were estimated; all data is tabulated. The study indicates that sea water can be converted in the range of 52 to 63 cents/thousand gallons in a 50 million gallon/day distillation plant using steam from a nuclear reactor. Part two consists of a summary report as an appendix, and contains the earlier research carried out on this project. Nuclear steam generating systems are described. The following distillation processes are discussed: (1) multiple effect evaporation; (2) multiple stage flash; (3) air-water direct contact; and (4) vapor compression distillation. Water costs, including capital and operating costs, for these processes are tabulated. Results of the entire study indicate that the two combination reactor-distillation systems considered as optimum are the heavy-water moderate and cooled reactor or the light-water moderated and cooled, slightly enriched reactor combined with a combination multiple-effect and multi-stage flash evaporator, or a long-tube vertical multiple-effect evaporator system. (Davison-IAP)
W79-04938

ECONOMIC EVALUATION STUDY OF DISTILLATION OF SALINE WATER BY MEANS OF FORCED-CIRCULATION VAPOR-COMPRESSION DISTILLATION EQUIPMENT,
B. F. Dodge, and A. M. Eshaya.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 395, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 21. 132 p, 60 fig, 29 tab, 38 ref. 14-01-001-101.

Descriptors: *Desalination, *Distillation, *Dropwise condensation, *Vapor compression distillation, *Economics, *Economic evaluation, Capital costs, Desalination plants, Desalination apparatus, Heat exchangers, Heat transfer, Scaling, Fixed costs.

A study to determine the economically optimum combination of the independent variables in a vapor compression cycle with forced circulation and dropwise condensation for desalination is reported. The following variables were considered: (1) brine velocity in tubes; (2) flashing fraction; (3) tube diameter, thickness, and type of exchanger; (4) temperature approaches in the main heat exchanger; (5) temperature approaches in the auxiliary exchangers; (6) pressure in the main heat exchanger; and (7) relationship of fixed charges, and energy costs to each other and to total costs. Because the optimum combination of variables may depend on the size of the plant, the following sizes were considered: 100,000 gpd; 1,000,000 gpd; and 10,000,000 gpd. The experimental and theoretical evidence indicate the dropwise condensation and forced-circulation will result in increasing the overall heat transfer coefficient in industrial distillation equipment by a factor of three to four. Forced-circulation is expected to improve the retardation of, or eliminate scale formation, particularly if the liquid is flashed in a chamber separate from the heat exchanger. At the optimum combination of variables the cost of the product ranges from $0.69 to $0.86/1000 gal for a 10,000,000 gpd plant, and capital costs range from $1.60 to $2.09/gpd, correspondingly. (Davison-IPA)
W79-04939

ENERGY AND MASS TRANSFER IN PARTIAL-PRESSURE DISTILLATION,
Wisconsin Univ.-Madison.
J. E. Davis, O. G. Lof, and J. A. Duffie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 408, Price codes; A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 131, November 1964. Annual Report Ending September 1, 1964. 54 p, 7 fig, 2 tab, 63 ref, 2 append. 14-01-0001-277.

Descriptors: *Mass transfer, *Distillation, *Solar distillation, *Desalination, Desalination processes, Separation techniques, Water purification, Water treatment, Saline water, Solar stills, Humidification, Water vapor, Evaporation, Condensation, Energy transfer, Conduction, Diffusion.

The work, to date, on an investigation of the transfer of water vapor across an air space between two parallel plane surfaces, where water is evaporating from one surface, and water vapor is condensing on the other, is reported. The relationship between transfer rates and the following variables is being examined; (1) temperature difference between the two surfaces; (2) temperature level of the gas layer; (3) the height to thickness ratio of the gas layer; and (4) orientation of the gas layer in relation to the vertical. A survey of the previous work in energy and mass transfer in solar distillation of saline water, film condensation, and convection phenomena is presented. The theoretical analysis results in the development of two sets of steady state transfer equations: (1) applicable to a conduction-diffusion process; and (2) applicable to a convection process involving temperature and concentration gradients at boundary layers adjacent to each plate. The experimental equipment is described, and accompanied by a flow diagram. Preliminary testing has established the minor design changes. Objectives of further preliminary testing include the achievement of satisfactory plate wetting, and accurate, reproducible temperature difference measurements. Actual distillation experiments will begin after 'dry runs' are made to calibrate the thermally insulated apparatus for heat losses to the surroundings. (Davison-IAP)
W79-04940

THERMODYNAMIC PROPERTIES OF SALINE WATER,
Monsanto Research Corp., Everett, MA.
B. M. Fabuss.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-178 986, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 136, July 1965. 66 p, 7 fig, 30 tab, 13 ref. 14-01-0001-294.

Descriptors: *Saline water, *Thermodynamics, *Physicochemical properties, Density, Vapor pressure, Desalination, Desalination processes, Correlation analysis, Mathematics, Equations, Water quality, Water analysis, Water properties.

Density measurements of water solutions of NaCl, KCl, NaSO4, MgSO4 and their ternary combinations were taken at 25 to 175C. The experimental density data were correlated; computational methods and equations were developed to calculate densities and partial molal values at other than measured concentrations and temperatures. The calculated density data agreed with the measured densities and with data published in International Critical Tables. The average standard deviation of

both experimental and calculated data for the four salts at all concentrations investigated over the given temperature range is about plus or minus 2.6 X 10-4 density units. Data from density measurements of the ternary solutions were correlated using apparent molal volumes. An equation using one interaction coefficient expressed the quantitative relationships in these systems. The average deviation for 54 ternary systems at the given temperature range was plus or minus 3.5 x 10-4 density units. Vapor pressure measurements on binary solutions of the given concentrations were taken at 25 to 150C. Vapor pressures of sodium chloride water solutions and activities of water are tabulated. (Davison-IPA)
W79-04941

INVESTIGATION OF INORGANIC ION EXCHANGE MEMBRANES FOR ELECTRODIALYSIS APPLICATION,
Douglas Aircraft Co., Inc., Newport Beach, CA. Astropower Lab.
C. Berger, R. Hubata, and M. Plizga.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-182 318, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 138, April 1965. 112 p, 22 fig, 32 tab, 32 ref. 14-01-0001-368.

Descriptors: *Membranes, *Ion exchange, *Inorganic compounds, *Electrodialysis, Desalination, Desalination processes, Films, Gels, Separation techniques, Anion exchange, Cation exchanges, Ion transport, Desalination apparatus, Laboratory testing, Electrochemistry.

A project undertaken to investigate the basic properties of inorganic ion exchanges and to study their fabrication into membranes to be used in electrodialysis is reported. Phase I of the two-phase program was concerned with the study of hydrous oxides and acid salts and the synthesis and study of anion exchangers. The three categories of anion exchangers distinguished were: (1) homogenous hydrous oxides; (2) heterogenous or 'mixed' hydrous oxides; and (3) basic salts. Of these, zirconium phosphate appeared to be the most promising, with an observed cation exchange capacity of 3.2 meg/gram at pH 6.6. A variety of techniques was used to fabricate coherent inorganic anion exchange membranes, and testing of these membranes yielded promising results in terms of strength, conductivity, and resistance to back-diffusion. The membrane forms retained the high anion exchange capacities exhibited by the original gels. When one membrane was tested in an electrochemical transference cell, a transport number of 0.76 was obtained, which established the ion selectivity of the membrane. (Davison-IPA)
W79-04942

SALINE WATER CONVERSION DEMONSTRATION PLANT, POINT LOMA I, SAN DIEGO, CALIFORNIA: SECOND ANNUAL REPORT.
Burns and Roe, Inc., New York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 247, Price codes: A13 in paper copy, A01 in microfiche. OSW Final Research and Development Progress Report No. 114, July 1964. 218 p, 7 fig, 20 tab, 5 append. 14-01-0001-233.

Descriptors: *Desalination plants, *Demonstration Plant No. 2, *Flash distillation, Facilities, Water treatment, Saline water, Sea water, Evaluation, Heat transfer, Operation and maintenance, Productivity, Computer programs, Pumps, Equipment, Costs, Operating costs, Capital costs, Maintenance costs, Point Loma, San Diego(California).

The San Diego Demonstration Plant No. 2, a flash distillation plant, was designed to produce 1 million gpd with a brine heater outlet temperature of 200F. A peak of 1,400,529 gallons was achieved in one 24 hour period with a brine heater outlet temperature of 240F. Information is provided for the final operation period of July 1, 1963 through February 26, 1964. A report of the organization and plant operation and maintenance includes organizational charts and a flow diagram of the plant. In evaluating the evaporators the following parameters are covered: heat transfer, performance, brine flow, venting, foaming, and the computer program. Other design features evaluated are: deaerator, air ejector, pumps, brine heater, auxiliary equipment, and sea water intake. Actual capital and operating costs and theoretical capital and operating cost for a normalized plant are presented. Monthly production and costs and cost of water/1000 gallons are tabulated, with and without amortization, for the entire operating period from March 1962 through February 1964. Monthly and daily production are illustrated with graphs and tables. (Davison-IPA)
W79-04943

RECOMMENDED PROCEDURES FOR THE TESTING AND EVALUATION OF CANDIDATE REVERSE OSMOSIS MEMBRANES FOR DESALINATION,
Office of Water Research and Technology, Washington, DC. Polymer and Biophysics Div.
H. E. Podall, and J. M. Shackelford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-182 766, Price codes: A02 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 268, September 1967. 20 p, 4 fig, 5 ref.

Descriptors: *Membranes, *Reverse osmosis, *Evaluation, *Membrane processes, *Testing procedures, *Laboratory tests, Laboratory equipment, Saline water, Brackish water, Desalination, Desalination apparatus, Films, Filters, Osmosis, Semipermeable membranes.

The best test of a reverse osmosis membrane is its assessed performance in the field on a given feed water. However, in developing new or improved membranes, laboratory testing under well defined conditions is desirable to precisely assess the effect of various feed water and process parameter variations. A discussion of process parameters, performance parameters, and intrinsic transport properties is followed by a presentation of experimental evaluation procedures. Typical cell designs and the recommended reverse osmosis test loop with a flat reverse osmosis test cell are illustrated. Necessary equipment tested by laboratory operation includes: pumps accumulator, high pressure lines, values, flow meter, pressure gauge, filter, porous metal plate, pressure relief value, and pressure regulator. Recommended test conditions and the determination of transport properties are presented. (Davison-IPA)
W79-04944

BIBLIOGRAPHY OF MEMBRANE TECHNOLOGY PERTAINING TO SALINE WATER DESALINATION: PART II.
Office of Water Research and Technology, Washington, DC. Biosciences Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 080, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development and Progress Report No. 153, November 1965. Compiled by Shackelford, J. M., and Kase, K. A. 56 p.

Descriptors: *Bibliographies, *Publications, *Patents, Documentation, Foreign projects, Desalination, Membranes, Membranes processes, Desalination apparatus, Desalination processes, Saline water, Water purification, Water treatment, Water quality, Water quality control.

A continuation of the Office of Saline Water Research and Development Progress Report No. 83, 'Bibliography of Membrane Technology Pertaining to Saline Water Desalination' is presented. The bibliography is in two parts: Part I contains literature references; Part II lists patents from the U.S., Britain, Japan, Australia, Belgium, Netherlands, France, Germany (West), Germany (East), Hungary, and U.S.S.R. (Davison-IPA)
W79-04945

BY-PRODUCTS FROM SALINE WATER CONVERSION PLANTS: A FEASIBILITY STUDY,
American Cyanamid Co., Stamford, CT.
A. J. Weingerger, and D. F. DeLapp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 695, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 110, September 1964. 14-01-0001-308.

Descriptors: *Desalination plants, *Saline water, *Byproducts, Capital costs, Descaling, Separation techniques, Sea water, Brackish water, Prices, Mineralogy, Chlorine, Bromine.

A survey with the objective of determining if the recovery of salable byproducts from minerals contained in saline waters could be practical in reducing the overall cost of converting saline water to fresh water is reported. Two novel integrated descaling and byproduct recovery processes for sea water conversion which show the most promise for reducing water conversion costs through the profitable sale of byproducts are examined. Since pre-softening of the feed water is an integral part of the water conversion process, there is no cost associated with either of the processes. Process I would produce bromine, magnesia, and refined salt. The byproducts from a 10 million gpd sea water conversion plant which could be sold at present bulk commercial prices and the would-be byproduct credit and capital requirements are tabulated. Chlorine, magnesia, bromine, and possibly refined salt would be produced by Process II. Because this process was developed late in the study, sufficient time was not available for the preparation of a preliminary estimate of the capital needed to build the required byproduct recovery plant. Process II appears more attractive due to the flexibility it allows in the choice of byproducts to be recovered. Other processes devised held lesser economical promise. It is concluded that sale of byproducts recovered from sea water conversion plant feed water has the technical and economic potential for reducing the overall cost of conversion. Inland waters were examined, and only a strong brine showed potential of economical recovery of byproducts. (Davison-IPA)
W79-04946

REVERSE OSMOSIS FIELD TESTING ON ACID MINE WATERS AT NORTON, WEST VIRGINIA,
Gulf General Atomic, Inc., San Diego, CA.
S. S. Kremer, A. Riedinger , J. H. Sleigh, and R. L. Truby.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-198 936, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 586, July 1970. 49 p, 5 fig, 13 tab, 2 ref, 1 append. 14-01-0001-1836.

Descriptors: *Acid mine water, *Desalination, *Reverse osmosis, *Gulf General Atomic high-flux perchlorate membrane, *Desalination apparatus, *Demineralization, Membranes, Membrane processes, Semipermeable membranes, Separation techniques, Mine wastes, Laboratory tests, Equipment, Laboratory equipment.

A 10,000 gpd reverse osmosis unit equipped with eighteen 50 sq ft modules was employed to study the demineralization of acid mine drainage by reverse osmosis. Tests were conducted to investigate additional operation of the reverse osmosis at recoveries higher than 75%, and to compare high-selectivity modules with high-flux modules, and 600 psi operation with 800 psi operation. A small reverse osmosis unit with 5.0 sq ft modules was used to compare the Gulf General Atomic high-flux perchlorate membrane with a commercial high-flux formamide membrane. The large high-flux modules exhibited comparable rejection and an increase in flux relative to the high-selectivity modules. There was no loss in rejection in operation at 800 psi when compared with 600 psi, but the effect of the increased pressure on flux is still unclear. Operation at 92% for recovery of feed water was easily achieved. The Gulf General Atomic high-flux perchlorate membrane exhibited

flux decline and rejection comparable to those of the commercial high-flux formamide membrane. Experiments on flux restoration by chemically treating the modules was successful. (Davison-IPA)
W79-04947

THE OSMIONIC PROCESS,
State Univ. of New York at Albany.
G. W. Murphy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 389, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 14, 1957. 71 p, 36 fig, 13 tab, 4 ref. 14-01-001-58.

Descriptors: *Membranes, *Osmionic membranes, *Osmosis, *Anion exchange, *Cation exchange, *Desalination apparatus, Desalination processes, Demineralization, Brackish water, Saline water, Equilibrium, Materials testing, Water purification, Water treatment, Sea water, Laboratory tests.

Research on the development of the basic theory for the single-effect osmionic cell is reported, followed by the extension of the theory to include multiple-effect cells and multiple-stage operation. The fabrication of the demineralization device is described. All experiments were carried out with commercial anion exchange membranes and cation exchange membranes. The experimental results include equilibrium and rate data over the concentration range 1,000 to 30,000 ppm of sodium chloride. Calculations are presented for typical cases. From these computations it is estimated that osmionic plant designs for brackish water based on either double-effect cells or double-stage operation of single-effect cells will require about 50% of the membrane area calculated for the single-effect, single-stage cell to produce the same amount of product water. Additional effects beyond two seem to have only a marginal advantage over the double-effect. For higher concentrations such as sea water, multiple-effects will be necessary. In designing a brackish water demineralization unit various membrane designs were considered, and all but 'Design C' were discarded. The development of laboratory osmionic cells of 'Design C' is presented in Part II of the report. The characterization and preparation of the membranes from four materials are described. The general properties of two of these membranes, poly-styrenesulfonic acid-dynel and polyvinylimidazole methiodide-dynel, are tabulated. (Davison-IPA)
W79-04948

DONNAN SOFTENING AS A PRETREATMENT TO DESALINATION PROCESSES,
Process Research, Inc., Cambridge, MA.
J. L. Eisenmann, and J. D. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 919, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 506, February 1970. 79 p 32 fig, 9 tab, 1 append. 14-01-0001-1782.

Descriptors: *Desalination, *Desalination processes, *Pre-treatment(Water), Membranes, Membrane processes, Ion transport, Calcium chloride, Flow rates, Velocity, Laboratory equipment, Laboratory tests, Computer programs, Correlation analysis, Water purification.

A study of the feasibility of the Donnan softening technique in establishing calcium transport rates in the feed waters of desalination plants, and relating these transport rates to solution concentrations, hydrodynamics, and membrane properties is reported. Several laboratory test scale systems were constructed and operated. Calcium transport data was obtained from three membrane types over a concentration range from 100 ppm to 500 ppm. Two different flow path geometries and range of flow velocities from 0.5 to 100 cm/sec were obtained. A methodology was developed correlating the experimental results from the varying types of experiments using a mathematical programming technique and a digital computer. The correlations of the results led to the development of a preliminary design rationale for the process. The costs of water softening using the Donnan process were estimated from the process design examples. One example shows the total cost of 3.66 cent/1000 gal for removing 50% of the calcium and magnesium from Webster, South Dakota water. A flow sheet shows the Webster, South Dakota electrodialysis plant utilizing the Donnan softening technique in a pretreatment system. (Davison-IPA)
W79-04949

BEHAVIOR OF WATER IN VARIOUS STATES,
New Mexico Highlands Univ., Las Vegas.
For primary bibliographic entry see Field 1A.
W79-04951

TRANSPORT OF ELECTROLYTES THROUGH MEMBRANE SYSTEMS, SECOND ANNUAL REPORT,
Southern Research Inst., Birmingham, AL.
M. S. Mintz, and R. E. Lacey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-178 530, Price codes: A04 in paper copy, A01 in microfiche. Research and Development Progress Report No. 259, 1967. 51 p, 7 fig, 15 tab, 1 append. 14-01-0001-464.

Descriptors: *Membrane processes, *Phenomonological admittance coefficients, *Electrolytes, *Ion transport, Membranes, Anions, Cations, Desalination, Desalination apparatus, Films, Laboratory tests, Permeability, Properties, Diffusion, Permselective membranes, Osmosis, Dialysis, Demineralization.

Research involving the calculation of admittance coefficients from improved experimental data, and the development of a method for predicting ionic transference numbers is reported. In using the improved experimental data, the characterization, under dynamic conditions, of the eight original membranes was extended to broader ranges of current densities in sodium chloride solutions. An additional four membranes were characterized under static and dynamic conditions. The additional membranes selected for study were: a silicone treated parchment, a denitrated nitro-cellulose, a cation-selective membrane, and an anion-selective membrane. In using the method for predicting ionic transference numbers, the values of transference numbers of sodium and chloride ions in near-neutral membrane systems predicted from data taken from potassium chloride solutions agreed with the experimentally measured ionic transference numbers. Preliminary studies were made of two different methods of arranging cation-selection and non-selective membranes for potential use in demineralization devices. Both arrangements are described. Most of the membranes studied exhibited an inverse relationship between water transference number, tau3, and current density; the cation transference number, tau1, decreased as the solution concentration increased. The value of tau1 of the near neutral membranes decreased at high densities as the current densities increased. (Davison-IPA)
W79-04952

FOURTH ANNUAL REPORT: SALINE WATER CONVERSION DEMONSTRATION PLANT NO. 1, FREEPORT, TEXAS.
Stearns-Roger Corporation, Denver, CO. Special Projects Division.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-189 422, Price codes: A11 in paper copy, A01 in microfiche. Research and Development Progress Report No. 171, April 1966. 191 p, 32 fig, 29 tab, 8 ref, 1 append. 14-01-001-218.

Descriptors: *Desalination plants, *Desalination processes, *Demonstration Plant No. 1, *Long-Tube Vertical distillation, *Desalination, Water purification, Mechanical equipment, Hydraulic machinery, Economics, Capital costs, Operating costs, Cost analysis, Cost comparisons, Evaluation, On-site investigations, Corrosion, Scaling, Construction materials, Evaporation.

A wide variety of information findings concerning the Long-Tube Vertical (LTV) multiple-effect evaporation method of desalination employed by Demonstration Plant No. 1, Freeport, Texas, is presented. Production, economy ratios, progressive costs averages, and maintenance problems are presented. The discussion of overall plant performance includes information on evaporator performance, heat rejection, deaeration, venting, and product water stabilization. Capital and operating costs are compared to theoretical 'normalized' capital and operating costs. A technical evaluation of the existing process, equipment, corrosion, and construction materials is included. The detailed process evaluation presents limitations of temperature and concentration ratios for scale-free operation of LTV evaporators without presoftening the feed water. Recommended plant modifications and proposed objectives of the development program are presented. A process flow diagram is included. (Davison-IPA)
W79-04953

REVERSE OSMOSIS MEMBRANE REGENERATION,
American Standard, Inc., New Brunswick, NJ.
E. A. G. Hamer, and R. L. Kalish.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-203 281, Price codes: A05 in paper copy, A01 in microfiche. Research and Development Progress Report No. 471, September 1969. 87 p, 8 fig, 22 tab, 16 ref, 1 append. 14-01-0001-1171.

Descriptors: *Membranes, *Reverse osmosis, *Cellulose acetate, *Cleaning, *Descaling, *Treatment, *Transport depletion, Membrane processes, Scaling, Feasibility studies, Ultrasonics, Chemical reactions, Compaction, Permeability, Desalination apparatus.

An investigation to determine the feasibility of extending the service life of cellulose acetate reverse osmosis membranes using surface cleaning and membrane regeneration procedures is discussed. The descaling experiments were performed on flat membranes coated with deposits of ferric oxide and calcium sulfate. The mechanical methods, ultrasonic vibration and sponge rubbing, were not effective beyond removing a superficial amount of the scale. Chemical removal was achieved with dilute solutions of 1 to 5% of sodium hydrosulfate and 0.2% oxalic acid at ambient temperature. Dilute solutions of hydrochloric and sulfamic were ineffective at ambient temperature. The sequestering agents were ineffective at ambient temperature, but the improved cleaning effect noted for citric and tartaric acids at 70C suggests that sequestation is a viable method at higher temperatures. The successful descaling reagents apparently do not damage the desalting properties of the membranes. Regeneration experiments were performed on flat virgin membranes subjected to accelerated compaction so that half their initial flux was lost. Membranes treated by heat soaking at temperatures close to those used in membrane preparation produced the best overall restored performance. (Davison-IPA)
W79-04954

RESEARCH CONTINUATION OF BADGER-HICKMAN CENTRIFUGAL DISTILLATION TESTING ON UNIT NUMBER 4.
Badger Co., Inc., Cambridge, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 390, Price codes: A05 in paper copy, A01 in microfiche. Research and Development Progress Report No. 15, March 1957. 74 p, 19 fig, 21 tab, 4 append. 14-01-001-81.

Descriptors: *Centrifugation, *Desalination, *Vapor compression distillation, Testing, Testing procedures, Evaluation, Measurement, Temperature, Condensers, Equipment, Desalination apparatus, Evaporation, Boilers, Corrosion, Scaling, Water treatment, Water purification, Sea water.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

Experimental work testing the utility of a centrifugal phase barrier as the boiler-condenser unit of a vapor recompression still for producing water from sea water is reported. The experiments covered: (1) redetermination of some previously accumulated data; (2) measurements of factors to increase the total knowledge of the centrifugal method and to demonstrate the utility of larger size rotors; (3) the resistance to corrosion, scaling, and other functional failures through the use of higher temperatures for longer periods. During these tests the still was in productive operation for more than 1,000 hours with no major mechanical trouble. The endurance tests were conducted at 125F, 150F, and 180F, and it was determined that 150F is a practical temperature for the economic operation of this type of distillation unit. Data collected at this temperature results show relatively high heat transfer coefficients with no visual scaling at these low evaporation temperatures. It is concluded that the No. 4 Badger-Hickman still can operate for 200 hours, and possibly longer, on sea water without serious loss of efficiency at temperatures of 150F and below. The 4.5-ft diameter rotor has a steady state operating heat transfer coefficient 4 times the average present commercial vapor compression stills. The No. 4 still conformed to and extended the performance characteristics of the previous centrifugal phase barrier stills. (Davison-IPA)
W79-04955

3B. Water Yield Improvement

HARD-ROCK WELLS GET MARIPOSA THROUGH THE DROUGHT,
California Dept. of Water Resources, Sacramento.
A. Swanson.
Pacific Groundwater Digest, Vol. 2, No. 1, p 11-15, January 1979. 3 fig, 1 tab.

Descriptors: *Water supply, *Water wells, *Drilling, *Droughts, Aquifers, Crystalline rocks, Groundwater, Well spacing, Storage, *California.

During the 1976-77 drought in California the Mariposa Public Utilities Department inititated a well-drilling program to augment their surface-water supply. Mariposa is underlain by metamorphic and granitic rocks and wells drilled into these formations produce only small yields. Thirty wells were drilled with an air-rotary rig. The wells ranged in depth from 85 to 450 feet. Only six of the wells produced over 10 gpm and were pumped continuously. Seven were pumped intermittently, some a few hours a day, others only a few days a month. A 22-month well production curve shows the increase due to the new wells, their gradual depletion, an increase due to the first rainfall of the season, and another decrease due to taking wells out of service as the drought lessened. The number of hard-rock wells needed in a semiarid climate is controlled by the amount of ground water in storage around the wells, not the pumping rate of the individual wells. Also, well spacing should be great enough to minimize interference. The total production rate should exceed the anticipated water consumption rate by a factor of three. Also, wells would produce longer if pumped at a smaller percentage of their maximum yield. (Purdin-NWWA)
W79-04579

AN ANALYSIS OF DROUGHT RESEARCH NEEDS FOR COLORADO AGRICULTURE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
W. A. Hall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 064, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report, September 1978. 67 p. OWRT A-038-COLO(1), 14-34-0001-8006.

Descriptors: *Drought, Water management, *Research priorities, *Soil conservation, *Soil-water-plant relationships, *Colorado.

An analysis was made of the research which must be accomplished in order to resolve drought related problems of Colorado, with particular emphasis on those problems relatively unique to Colorado. This work was based on the report 'Drought Research Needs' by Yevjevich, Hall and Salas (Nov. 1977), on consultations with Regional Directors and others of the Extension Service, the reactions of farmers in southeastern Colorado, and from personal experiences during nearly 25 years of research in agricultural water management practices and from a number of years spent in research policy related positions with the Federal government. This report further refines and identifies specific research requirements of Colorado using the Problem-Based Research Needs Analysis procedure developed earlier by the Federal Committee on Water Resources Research and Office of Water Research and Technology.
W79-04964

3C. Use Of Water Of Impaired Quality

ADVANCED STEPS TOWARDS THE POLLUTION-FREE BLEACHED SULFITE MILL,
IVL-Consulting Ltd., Goteborg (Sweden).
S. Bergkvist.
Svensk Papperstidning, Vol. 81, No. 13, p 423-425, September 25, 1978. 3 tab.

Descriptors: *Sulfite pulp mills, *Water pollution control, *Air pollution control, Wastes, Industrial wastes, Water pollution sources, Pulp wastes, Bleaching wastes, Pulp and paper industry, Sulfite liquors, Effluents, Capital costs, Costs, Burning, Pollution abatement, Bleached pulp mills, Spent sulfite liquor, Chemical recovery, Recovery furnaces, Washing(Pulp).

A survey has been conducted on possible methods for production of bleached sulfite pulps with minimum air and water pollution. For Mg-base sulfite mills environmental protection technologies have been adapted from Na-base mills. Dissolving-pulp mills can obtain a chlorine-free effluent suitable for joint chemical recovery with total mill effluents by introducing an NaOH extraction stage prior to bleaching. Considerable pollution reductions can be attained by oxygen bleaching of paper-grade sulfite pulps with NaOH as the base and including the oxygen stage in a closed washing cycle. Combustion of Na/Mg-base spent sulfite liquor can be performed in a conventional Mg recovery boiler with minor modifications, but the Na salts should be washed out from the MgO ash to avoid Na buildups in the mill system. All of the above-mentioned techniques were proven to be practicable in actual mill trials of several weeks duration. The capital expenditure for introducing Na into an existing Mg-base mill can be considerable, but will vary with the available equipment. When erecting a new Mg-base mill, however, the added investment for applying the Na/Mg technology should be low. (Brown-IPC)
W79-04639

MULTISOURCE/MULTIQUALITY AGRICULTURAL WATER USE DECISIONMAKING,
Office of Surface Mining Reclamation and Enforcement (DI), Washington, DC. Branch of Environmental Analysis.
M. A. Boster, and W. E. Martin.
Water Resources Bulletin, Vol. 15, No. 1, p 206-219, February 1979. 3 fig, 4 equ, 9 ref.

Descriptors: *Irrigation economics, *Water quality, *Conjuctive use, *Linear programming, *Computer models, *Irrigated farms, *Decision making, Irrigation water, Salinity, Agriculture, Imported water, Water resources, Projects, Regional analysis, Evaluation, Prices, Water policy, Equations, Effects, Optimization, Constraints, Systems analysis, Pinal County(Arizona), Yield reductions, Profit maximization.

The importation of water into an existing irrigated agricultural area raises many questions concerning farm profitability and suggests many adjustment alternatives open to farmers. In particular, how will farmers respond to a new additional water source of differing cost, availability, and quality. Linear programming computer models of representative irrigated farms in Pinal County, Arizona have been developed to project agricultural adjustments to new water from the Central Arizona Project now under construction. The models of farm enterprises in Pinal County maximize profits by maximizing net returns above variable production costs. Alternative courses of action available to the farmer include the different ways to produce a crop, the production of different levels of output for each crop, and the alternative crops which could be produced. The models reflect one crop season. The techniques developed have broad application to similar water resource projects involving the conjunctive use of multiple water sources of differing price and quality. Various management schemes can be evaluated by properly selected representative farm models. (Bell-Graf--Cornell)
W79-04693

3D. Conservation In Domestic and Municipal Use

WATER-CONSERVATION METHODS TO MEET PENNSYLVANIA'S WATER NEEDS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
P. W. Fletcher, and W. E. Sharpe.
Journal of the American Water Works Association, Vol. 70, No. 4, p 200-203, April, 1978, 11 ref. OWRT-A-999-PA(5), 14-34-0001-8040.

Descriptors: *Water utilization, *Water conservation, *Septic tanks, *Domestic wastes, Water pressure, Water supply development, Consumptive use, Water supply, Sewerage, Infiltration, Waste water treatment, Waste water disposal, Municipal wastes.

Sources of potential water conservation in Pennsylvania are reviewed with respect to reducing the load on sewage treatment plants and residential waste water treatment sites. Water-saving devices attached to showerheads, toilets, and sinks can reduce water closet use to 3.5 gal/flush, compared to the conventional 4-6 gal, and shower water discharge to 3.5 gal/min, compared to the conventional 4-10 gal/min. Pressure-reducing valves can be installed to reduce residential water pressure to 340-410 kPa. Compressed air-assisted showers and water closets can reduce water consumption to 0.5 gal/min and 0.5 gal, respectively. Water saving devices can reduce sewage flows to the treatment plant by up to 7% and flows to residential on-lot disposal fields by 40%; infiltration-inflow comprises about 30-40% of the treatment plant influent, necessitating sewer line studies and corrections. Further water and energy saving techniques can be applied to dishwashers, clothes washers, and water heaters. (Lisk-FIRL)
W79-04598

ESTIMATION OF URBAN IRRIGATION WATER USE AND REQUIREMENT,
Hawaii Univ., Honolulu. Dept. of Civil Engineering.
Y-S. Fok, and E. T. Murabayashi.
Paper No. 78-2030, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 7 p, 7 ref. ASAE, St. Joseph, Michigan.

Descriptors: Water conservation, *Irrigation water, *Landscaping, Consumptive use, Water requirements, Aesthetics, Water utilization, *Lawns.

The difference between normal urban irrigation water use and the consumptive use requirement is the potential amount of water that might be saved without adverse economic consequences to urban property values. Methods for the estimation of urban irrigation water use and requirement are presented. (Skogerboe-Colorado State)
W79-04984

3E. Conservation In Industry

ADVANCED STEPS TOWARDS THE POLLUTION-FREE BLEACHED SULFITE MILL,
IVL-Consulting Ltd., Goteborg (Sweden).
For primary bibliographic entry see Field 3C.
W79-04639

UTILIZATION OF EVAPORATOR CONDENSATES AS A REPLACEMENT FOR FRESH WATER (ISPOL'ZOVANIE KONDENSATOR VYPARNOGO TSEKHA VZAMEN SVEZHEI VODY),
Sibirskii Nauchno-Issledovatelskii Inst. Tsellyulozy i Kartona (USSR).
For primary bibliographic entry see Field 5D.
W79-04646

3F. Conservation In Agriculture

USE OF METHANOL-WATER SOLUTIONS FOR FREEZE PROTECTION OF TENSIOMETERS,
Texas A and M Univ., Lubbock. Agricultural Research and Extension Center.
C. W. Wendt, O. C. Wilke, and L. L. New.
Agronomy Journal, Vol. 70, No. 5, p 890-891, September-October, 1978. 2 fig, 1 tab, 2 ref. OWRT C-7642(No. 7252)(1), 14-34-0001-7252.

Descriptors: Freezing, *Tensiometers, *Soil water, Soil water movement, Irrigation schedule.

The use of tensiometers to schedule irrigations has been limited primarily to summer crops because of water freezing in the tensiometers during the winter months. Since methanol-water mixtures have lower freezing points than water, a greenhouse study was conducted using an Olton loam soil (Acridic Paleustolls) to determine the effect of a methanol-water mixture (30% methanol by volume) on tensiometer readings and plant growth. No major effects of tensiometer readings or plant growth were noted. Results from a field demonstration on irrigated winter wheat (Triticum aestivum L.) indicate that tensiometers with such mixtures can be used to estimate soil water tension changes at atmospheric temperatures down to -18.8C. (Skogerboe-Colorado State)
W79-04605

THE EFFECT OF SALT PRECIPITATION AND HIGH SODIUM CONCENTRATIONS ON SOIL HYDRAULIC CONDUCTIVITY AND WATER RETENTION,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2G.
W79-04650

NITROGEN SOURCES FOR HAY PRODUCTION ON FLOODED MEADOWS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
A. E. Ludwick, C. B. Rumburg, and E. G. Siemer.
Soil Science Society of America Journal, Vol. 42, No. 3, p 509-512, May-June, 1978. 7 tab, 13 ref.

Descriptors: *Nitrogen compounds, Ammonium compounds, Fertilizers, Ureas, Nitrates, Denitrification, *Hay.

Three experiments were conducted over a 3-year period to compare various urea materials and ammonium nitrate as N sources for hay production on flooded meadow sites. Each experiment was a complete factorial combination of fertilizer N sources and rates broadcast once in the spring on established forage prior to flood irrigation. The N sources in these experiments consisted of ammonium nitrate, urea, sulfur-coated urea, urea ammonium polyphosphate and urea ammonium sulfate. Hay yields and N uptake were significantly increased by N fertilizer at each location; there was no significant response in hay yield or N uptake resulting from residual N in the second season of Experiment 1. Source of N did not influence hay yields nor N uptake. The N content of the hay was significantly influenced by the N fertilizer rate at two locations and the N source at one location. In general, hay yields and N uptake increased with increasing rates of fertilizer N. Fertilizer efficiency was low at all locations, ranging between 8.5 and 19.6 kg hay/kg N. Fertilizer N recovery was <30% for all treatments. Both efficiency and recovery of N tended to decrease with increasing N rates. (Kogerboe-Colorado State)
W79-04653

AGRICULTURE AND SALINITY,
For primary bibliographic entry see Field 5G.
W79-04659

EFFECTS OF AVAILABILITY OF WATER ON IRRIGATION SYSTEMS OPERATIONS,
Idaho Univ., Moscow.
J. R. Worstell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 714, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, October 1978. 90 p, 2 fig, 28 tab, 54 ref, 3 append. OWRT B-039-IDA(2). 14-34-0001-7152.

Descriptors: *Irrigation systems, *Irrigation efficiency, Droughts, Irrigation management, Conjunctive use.

An analysis was made of the effects of water shortage on two different irrigation systems. Irrigation diversion and delivery data were analysed. Estimates were made of consumptive use, of conveyance efficiencies. The analysis was made for different periods of time during the irrigation season and results reported for each time period for project irrigation efficiencies, unit irrigation efficiencies, and conveyance efficiencies. Comparisons of two rather unlike systems, one of which had been used to operating with shortages showed that during the 1977 drought year there was no marked change in the irrigation efficiencies for the irrigation districts studied. In the one case pumping of ground water was used as a means of supplementing supplies. This probably accounted for the tendency for irrigation efficiency to not change very markedly.
W79-04683

OPTIMAL IRRIGATION MANAGEMENT STRATEGY UNDER HYDROLOGIC AND IRRIGATION EFFICIENCY UNCERTAINTY REGIMES,
Idaho Univ., Moscow.
C. N. Udeh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 707, Price codes: A09 in paper copy, A01 in microfiche. PhD Dissertation, April 1978. 186 p, 30 fig, 33 tab, 201 ref, 2 append. OWRT B-039-IDA(1). 14-34-0001-7152.

Descriptors: *Irrigation efficiency, *Irrigation systems, *Mathematical models.

Optimization of the operation and management of an irrigation system is dependent on variability of the hydrologic phenomenon and variability in the various uncertainties involved in irrigation water use that are often lumped as irrigation efficiency. A Bayesian decision theory was developed to incorporate the uncertainties of hydrologic phenomenon and irrigation efficiency considering both time and space variation. Major inputs to the model included irrigation diversions, probabilistic irrigation efficiencies, three crop response functions, utility functions, irrigation production cost and crop price functions, consumptive use data and seasonal crop yield coefficients. The system modeled was an unimproved gravity irrigation system. The model was tested on an irrigation district located in Blaine County, Idaho. Results indicated that costs for irrigation water use and crop production costs as input functions were not as critical in influencing optimum results as the probabilistic hydrologic and irrigation efficiency parameters.
W79-04685

CHANGES IN BIOCHEMICAL CHARACTERISTICS OF CHERNOZEM SOILS IN THE REGION OF THE WESTERN SLOPE OF THE URAL MOUNTAINS DURING IRRIGATION,
Akademiya Nauk SSSR, Ufa. Inst. of Biology.
For primary bibliographic entry see Field 2G.
W79-04706

WATER ABSORPTION BY PLANTS IN A DRY WIND AND UNDER PERIODIC SPRAYING WITH WATER (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Inst. of Plant Physiology.
V. G. Egorov, G. V. Lebedev, V. Z. Dumbadze, and V. G. Bryukvin.
Fiziol Rast (Mosc) Vol. 24, No. 1, p 188-190, 1977.

Descriptors: Beans, *Humidity, Tea, Temperature, *Crop response, *Winds.

Bean and tea plants were subjected to a dry wind (43-45 degrees C, 25% humidity for beans and 36-37 degrees C, 30% humidity for tea at a rate of 3-4 m/s) while soil temperature and moisture level were held constant. Water absorption by plant root systems increased sharply under the effect of the wind, but decreased during periodic pulsed spraying of plants with water droplets. Thus this procedure may be used as a method for controlling the harmful effects of a dry wind on crops.--Copyright 1978, Biological Abstracts, Inc.
W79-04707

PHYSIOLOGICAL REACTION OF DIFFERENT CORN HYBRIDS TO DROUGHT (IN RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Kukuruzy, Dnepropetrovsk (USSR).
M. Ya. Tregubenko, G. L. Filippov, N. V. Vishnevskii, and L. A. Maksimova.
S-kh Biol Vol. 12, No. 3, p 412-418, 1977. English summary.

Descriptors: Photosynthesis, Respiration, Transpiration, *Drought resistance, *Crop response, *Corn, Plant physiology.

Water exchange, intensity of respiration and photosynthesis, resistance of plants of overheating and dehydration by the release of electrolytes from tissues of different corn hybrids were studied. Drought-resistant hybrids display high plasticity during drought. The decrease of the intensity of respiration and photosynthesis is less significant, the water-holding ability of leaves increases, and the release of electrolytes from tissues and the intensity of transpiration decreases.--Copyright 1978, Biological Abstracts, Inc.
W79-04708

CORN RESIDUE MANAGEMENT TO REDUCE EROSION IN IRRIGATION FURROWS,
Science and Education Administration, Prosser, WA. Agricultural Research.
For primary bibliographic entry see Field 4D.
W79-04724

POSSIBLE USE OF TRANSPIRATION WATER CONDENSATE OF SWEET POTATOES IN CULTIVATING PLANTS IN BIOLOGICAL LIFE SUPPORT SYSTEMS (IN RUSSIAN),
T. A. Derendyaeva.
Kosm Biol Aviakosm Med Vol. 10, No. 6, p 70-73, 1976. (English summary).

Descriptors: Transpiration, Biocontrol, Sweet potato, Crop response.

The effect of nonpurified condensate obtained during prolonged cultivation of batata (sweet potato, Impomoea batata) in a sealed chamber on batata cuttings and seedings of garden cress, radish and Chinese cabbage was studied. Nonpurified condensate produced an inhibitory effect on the formation of roots in batata cuttings and on the growth of previously developed roots of batata cuttings and seedlings. The studies, which used a chemical model of 3,4-dihydroxy phenylalanine in-

dicated that the condensate contained biologically active substances of organic origin. Only experiments with the real continuous culture of batata, using real dilutions of the condensate that depend on the size of the greenhouse and the amount of the nutrient solution, would clarify whether condensate of transpiration water of batata plants can be repeatedly utilized in life support systems (growing other agricultural plants under artificial conditions).
W79-04758

WATER BANKING: HOW TO STOP WASTING AGRICULTURAL WATER,
California Univ., Berkeley. Graduate School of Public Policy.
S. Angelides, and E. Bardach.
Institute for Contemporary Studies, San Francisco, CA, January 1978. 56 p, 1 fig, 92 ref.

Descriptors: *Water use, *Water resources planning, *Water law, *Water banking, *Water rights, *Water allocation(Policy), *Water consumption, Agriculture, Water resources development, Water resources, Economics, California, Legislation, Water transfer, Political constraints.

This study analyzes the history of agricultural water waste in California and proposes recommendations for policy change to effect wiser consumption of water resources. Past water policies have encouraged farmers to use water beyond their needs without paying increasing penalties for such waste. Agriculture consumes 85% of California's water; savings in agricultural water use would increase supply to the State's residential and industrial users. Existing water allocation systems, water rights law and water agency law have only encouraged waste by allowing use on a first come-first served basis rather than by the establishment of a priority system based upon type of use. A water transfer rights system is hampered by specific legal prohibitions and by procedures to protect 'third parties' to water use. The authors recommend a banking system--the purchase of water from some users by a water agency and its resale to other users--to be set up by each water agency. Such a system would expedite water transactions and act as an intermediary between sellers and buyers of water rights. The water banking proposal is described, benefits are presented, and the political prospects are discussed. Without effective political support of interested legislators and the State's water establishment, adoption of the water banking concept will be difficult, perhaps impossible. (Arnold-NC)
W79-04875

COMPUTER PROGRAMMING SOLID SET SYSTEMS,
Toro Co., Riverside, CA.
S. G. Griffin.
Paper No. 78-2012, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 9 p. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Uniformity coefficient, *Computer programs, Water shortage, Simulation analysis, Nozzles, Design criteria, *Irrigation efficiency.

Solid set sprinkler system uniformity is of great importance in today's agriculture. A computer program for evaluating sprinkler performance has been developed. This program has shown to be valuable in product development as well as providing more accurate information on system operation to the grower in the field. (Skogerboe-Colorado State)
W79-04913

SIZING TAILWATER RECOVERY SYSTEMS TO UTILIZE RUNOFF FROM PRECIPITATION ON IRRIGATED LANDS,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
H. L. Manges, and T. L. Mao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 023, Price codes: A03 in paper copy, A01 in microfiche. Kansas Water Resources Research Institute, Kansas State University. Contribution No. 202, January 1979. 41 p, 4 fig, 8 tab, 16 ref. OWRT A-077-KAN(1), 14-34-0001-7035.

Descriptors: *Furrow irrigation, Deep percolation, *Irrigation efficiency, *Tailwater, Runoff, Precipitation, Groundwater.

A tailwater management model was developed to simulate runoff from precipitation, and to maintain a daily water budget on irrigated land and in the tailwater pit. Equations were developed to predict runoff from precipitation utilized for irrigation and pumping from ground water necessary for irrigated crop production. The model was run for the period 1949 to 1973 for furrow irrigated corn grown on two commonly irrigated soil types at Garden City and Larned, Kansas. About 25 percent of the runoff from precipitation can be utilized through proper management of normal size tailwater pits. Utilization of runoff from precipitation can be increased to about 70 percent by building tailwater pits five times their normal size. An economic analysis was made to determine the feasibility of building a larger than normal tailwater pit to utilize runoff from precipitation. At present energy prices, it is not economically feasible to build a larger tailwater pit to utilize runoff from precipitation. As the price of energy rises in the future, it may be economical to do so, especially when pumping from depths in excess of two hundred feed.
W79-04960

AN ANALYSIS OF DROUGHT RESEARCH NEEDS FOR COLORADO AGRICULTURE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3B.
W79-04964

ENVIRONMENTAL AND INSTITUTIONAL ASPECTS OF IRRIGATION AGRICULTURE,
Science and Education Administration, Riverside, CA. Salinity Lab.
J. van Schilfgaarde.
Paper No. 78-2045, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 6 p. 7 ref. ASAE, St. Joseph, Michigan.

Descriptors: Irrigation, Salinity, Drainage, *Institutional constraints, Environmental effects, Social aspects, *Irrigated land, Irrigation design.

Irrigation agriculture requires drainage, but design options and water management choices impact not only agricultural production. A host of institutional and societal considerations affect the viability of technically feasible alternatives. Drainage, as an integral part of water management, must be viewed within this larger framework and options identified that optimize total resource use. (Skogerboe-Colorado State)
W79-04978

MANAGEMENT FOR MINIMIZING NITROGEN LEACHING LOSSES ON IRRIGATED SANDY SOILS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
D. Watts, D. Martin, P. Tscheschke, and M. England.
Paper No. 78-2025, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 22 p. 14 fig, 8 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Nutrient removal, Nitrogen, Nitrates, *Leaching, Organic matter, Nitrogen fixation, *Corn, Nebraska, Soil texture.

A model study was made to evaluate nitrogen uptake and the loss of water and nitrate from the root zone of irrigated corn on sandy soils in Western Nebraska. Three N sources, two N amounts and a wide range of irrigation applications were simulated for growing seasons with normal and 75 percent above normal rainfall. Control of irrigation amounts to minimize percolation and proper selection of nitrogen amount and source all had a significant effect on nitrate leaching loss. (Skogerboe-Colorado State)
W79-04980

PEACH TREE RESPONSE TO DRIP APPLICATION OF WATER AND NUTRIENTS,
Georgia Univ., Athens. Dept. of Agricultural Engineering.
J. L. Chesness, and G. A. Couvillon.
Paper No. 78-2019, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 19 p. 1 fig, 4 tab, 36 ref. ASAE, St. Joseph, Michigan.

Descriptors: Irrigation systems, Crop response, Crop production, *Peaches, Nutrient requirements, *Drip irrigation.

Two years of peach tree response to drip irrigation were reported on. Four treatments involving two water regimens and two water applied fertilizer rates were investigated. Yield in kg/cm trunk diameter/tree averaged 43 percent higher for the irrigated treatments. There was no significant difference in the yield and elemental leaf tissue levels for trees receiving one-half levels of nutrients applied through the system. (Skogerboe-Colorado State)
W79-04981

CONTOUR FURROW IRRIGATION WITH LIQUID MANURE USING 'MICROTUBING' FOR FLOW CONTROL,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
W. R. DeTar.
Paper No. 78-2027, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 45 p. 15 fig, 9 tab, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Contour furrows, *Furrow irrigation, Fertilizers, Liquid wastes, Flow control, Irrigation systems.

The trickle-furrow concept is introduced. The low infiltration rate of dilute liquid manure makes possible 100 ft lengths of run with only 0.3 gpm/furrow. Furrows can run 8 hrs/set. Proposed is a solid-set arrangement of 1000 ft of corrugated plastic tubing laterals descending 5-10% slopes with microtubing outlets at each furrow. Field experiment yields rate-of-advance curves. A prediction equation is given for length of run. Friction loss data are presented. Work is still in progress. (Skogerboe-Colorado State)
W79-04982

ASSESSING TRICKLE EMITTER APPLICATION UNIFORMITY,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
F. S. Nakayama, D. A. Bucks, and A. J. Clemmens.
Paper No. 78-2017, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978. Logan, Utah, 7 p, 6 fig, 2 tab, 4 ref, 2 append. ASAE, St. Joseph, Michigan.

Descriptors: Irrigation systems, Uniformity coefficient, Water conservation, Application methods, *Irrigation efficiency, *Sprinkler irrigation, Statistical methods, Flow rates, Frequency curves.

A method was developed for showing the uniformity of water application by trickle emitters based on the emitter's coefficient of variation. The derived design uniformity coefficient equation for different numbers of emitters per plant was related to the uniformity coefficient used in sprinkler irrigation. The interrelationship between the computed design uniformity coefficient, the manufacturer's coefficient of variation for the emitter, and the

number of emitters per plant can be used as a guide for selecting the number of emitters per plant. In addition, a field uniformity coefficient and a field emitter coefficient of variation were related to the fraction of plants adequately irrigated. (Skogerboe-Colorado State)
W79-04990

DRIP IRRIGATION OF ORANGE TREES IN HUMID CLIMATE,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
J. M. Myers, and D. S. Harrison.
Paper No. 78-2018, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 7 p, 8 tab, 8 ref. ASAE St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Irrigation systems, *Oranges, Humid climates, Citrus fruits, Crop production, Statistical methods, Florida, *Drip irrigation.

Results of a four-year study of drip and overhead sprinkler irrigation on orange trees grown in Florida on a sandy soil indicate responses are highly dependent on rainfall amounts and characteristics. For a year with rainfall 28% below normal average yields from trees with 2, 4 and 6 emitters/tree were 4.00,4.24 and 4.83 boxes/tree, respectively. Yields for sprinkler and no irrigation checks were 4.41 and 2.37 boxes/tree. Differences in yield between the three drip irrigation treatments and the sprinkler check were not significant at the 95% confidence level, however, all four of these treatments were significantly better than the no irrigation check. Average yields for quantities of water for drip irrigation were 4.13, 5.16 and 5.43 boxes/tree for low, medium and high amounts, respectively. The statistical significance of the water quantity results are identical to those for the emitter density results. Supplemental fertilizer application, through the drip water distribution system, of 19-0-19 k/ha/year and 38-0-38 k/ha/year of N-P-K did not appear to influence yields of oranges. Irrigation treatments did not significantly affect production in years with average or above average treatment or rainfall. (Skogerboe-Colorado-State)
W79-04991

ECONOMIC ANALYSES OF MULTIPLE PIVOT IRRIGATON ON A DROUGHTY SOIL,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
M. A. Otterby, and D. W. DeBoer.
Paper No. 77-2006 presented at the 1977 Annual Meeting of the American Society of Agricultural Engineers, June 26-29, 1977, Raleigh, North Carolina. 18p, 4 fig, 6 tab, 8 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Crop production, Corn, Alfalfa, Soils, *Irrigaton practices.

Economic analyses consisting of annual costs and returns were used to compare the profitability of using one center pivot irrigation machine on more than one field. Corn and alfalfa yields from an associated field study were used as a basis for the analyses. For corn, one center pivot machine used to irrigate one corn field gave the highest return to land and management. For alfalfa, one center pivot machine for two fields gave the highest return. (Skogerboe-Colorado State)
W79-04995

MINIMIZING SALT IN RETURN FLOW THROUGH IRRIGATION MANAGEMENT.
Agricultural Research Service, Riverside, CA. Salinity Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 637, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-134, July, 1977. 111 p, 43 fig, 37 tab, 23 ref, 2 append.

Descriptors: Arizona, Salts, *Irrigation effects, *Return flow, *Leaching, Alfalfa, Surface irrigation.

Two field experiments are being conducted in southwestern Arizona to investigate the potential of reducing the salt load in irrigation return flow by decreased leaching. Three leaching treatments of 5, 10, and 20 percent, replicated nine times for citrus and five times for alfalfa, were established and compared with conventional flood irrigation management. (Skogerboe-Colorado State)
W79-04996

POTATO AND LETTUCE RESPONSE TO IRRIGATION METHODS AND PRACTICES,
New Mexico State Univ., Las Cruces.
T. W. Sammis, and E. G. Hanson.
Paper No. 78-2020, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 11 p, 2 fig, 7 tab, 9 ref. ASAE, St. Joseph, Michigan.

Descriptors: Irrigation practices, Irrigation systems, Surface irrigation, Subsurface irrigation, Sprinkler irrigaton, *Potatoes, *Lettuce, *Irrigation efficiency, Crop response, Crop production.

Spring potatoes and fall lettuce were irrigated with sprinkler, trickle, subsurface, and furrow irrigations for two consecutive years. Results are presented that pertain to the influence of these methods on crop yield, water-use efficiency, quality at maturity, and the variability of measurements. The lowest irrigation ratio for two consecutive years was achieved by trickle and subsurface irrigation. Water-use efficiency was indeterminate for the 1975 lettuce cropping year. In 1976, subsurface irrigation of lettuce resulted in the highest water-use efficiency. Subsurface and trickle irrigation of potatoes resulted in the highest water-use efficiency in 1975, and by subsurface irrigation of potatoes resulted in the highest water-use efficiency in 1976. (Skogerboe-Colorado State)
W79-04997

QUANTIFICATION OF RICE YIELD BENEFITS ATTRIBUTABLE TO IRRIGATION WATER,
International Rice Research Inst., Los Banos, Laguna (Philippines). Dept. of Irrigation and Water Management.
S. I. Bhuiyan, and A. Sumayao.
Paper No. 78-2022, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 12 p, 15 fig, 1 tab, 16 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Rice, *Irrigation, Moisture stress, Crop response, Crop production, Yield equations, Regression analysis, Irrigation effects.

An experiment with a split-plot design was conducted at three different locations to grown LR-36 variety of rice in the dry season when no crop can be grown without irrigation water in order to quantify rice yield benefits due to irrigation under farmers' field condition. Five irrigation treatments, representing various degrees of water stress during the reproductive growth stage of the crop, were imposed in the main plots and three management package treatments, representing the average farmer's level, intermediate level and high level use of other inputs, were imposed in the subplots. High level of management combined with adequate water produced about 5.1 t/ha, whereas farmer level management under adequate water yielded 2.9 t/ha. Yield was reduced consistently as stress days increased. An average of thirty-one stress days caused a yield reduction of 1.0 t/ha under the farmer level management, but an average reduction of about 1.5 t/ha under the two higher level managements. A regression model developed showed that the location of the experiment had no significant effect on the yield. The model predicts yield variation due to stress days and levels of managment. Management was found to have a much stronger influence on yield than water stress. (Skogerboe-Colorado State)
W79-04999

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

BROWNS FERRY BIOTHERMAL RESEARCH SERIES. I. COLONIZATION BY PERIPHYTON, ZOOPLANKTON, AND MACROINVERTEBRATES,
Tennessee Valley Authority, Decatur, AL. Div. of Forestry, Fisheries and Wildlife Development.
For primary bibliographic entry see Field 5C.
W79-04533

LOSS OF HIGH FLOWS BY SEEPAGE FROM STREAM CHANNELS IN KANSAS,
P. R. Jordan.
Kansas Water News, Vol. 21, Nos. 1 & 2, p 30-40, 1978. 3 fig, 2 ref.

Descriptors: *Seepage, *Water loss, *Subsurface runoff, Surface-groundwater relationships, Runoff, Hydrologic data, Groundwater recharge, Soil moisture, Bank storage, Influent streams, Gaging stations, *Kansas.

Seepage loss during high flow in Kansas streams contributes to ground-water recharge, soil-moisture storage and bank storage. A small amount is lost by evaporation. Hydrologic modeling of aquifer-stream dynamics requires data on seepage loss. This report discusses general relationships that can be used for estimating seepage losses for high flow when direct data are not available. Seepage loss data are obtained by measuring the difference in stream flow at two consecutive gaging stations. It is expressed as a percent of the flow volume at the upper station. The average seepage loss per square mile was plotted against flow at upper station for diminishing streams and streams in western and central Kansas. The variation between streams is less than the variation between different events on the same stream. Diminishing streams have the highest average seepage losses from 2.7 to 5.8 percent per mile. Seepage loss for medium to large streams in western Kansas averages 1.3% per mile. For central seepage losses tend to be smaller than those in western Kansas. In eastern Kansas, seepage losses of storm run off are rare or non-existent. (Purdin-NWWA)
W79-04577

HYDROLOGIC IMPACT OF GRAZING SYSTEMS ON INFILTRATION AND RUNOFF: DEVELOPMENT OF A MODEL,
Utah State Univ., Logan. Coll. of Natural Resources.
For primary bibliographic entry see Field 2A.
W79-04585

A NONLINEAR ANALYSIS OF THE RELATIONSHIP BETWEEN RAINFALL AND RUNOFF FOR EXTREME FLOODS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2A.
W79-04604

CHARACTERIZATION OF THE GROWTH OF MYRIOPHYLLUM SPICATUM AND ITS INFLUENCE IN THE AQUATIC ECOSYSTEMS OF THE TENNESSEE VALLEY,
Tennessee Univ., Knoxville.
C. C. Amundsen, and A. L. Brenkert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 696, Price codes: A05 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee, Research Report No. 67, December 1978. 86 p, 242 ref. OWRT B-037-TENN(1). 14-34-0001-8119.

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

Descriptors: *Aquatic weeds, Aquatic weed control, Myriophyllum spicatum, Rooted aquatic plants, Eurasian water milfoil, Macrophytes.

The literature concerning Eurasian watermilfoil (Myriophyllum spacatum L.) is reviewed. The purpose is to understand more clearly which factors in an aquatic ecosystem may have a determining influence on whether a species of aquatic macrophyte becomes an aggressive weed. Consideration of the taxonomy and genetics of watermilfoil provides no conclusive evidence for the claim that Myriophyllum spicatum L. is an introduced species. The growth form of Eurasian watermilfoil allows it to out-compete any other aquatic macrophyte. The mass of long leafless stems with the dense canopy of branches at the top layer of the water column easily moving up and down with any water level fluctuation does not give other aquatic macrophytes a chance to coexist in the same space. Moreover the extensive rhizome system and the delayed senescence of the vegetative mass makes it possble for milfoil stands to hold their place from year to year. Water drawdown in reservoirs only increases the spread of milfoil, for new shoots will form at the edge of the stands at bed depths where previously little light penetrated. The abscission of the lateral branches at certain times of the year and the immediate formation of adventitious roots enables the weed to spread to new areas.
W79-04625

INSTITUTIONAL CONCERNS: THE DELAWARE EXPERIENCE,
Geological Survey, Milford, PA. Water Resources Div.; and Geological Survey, Reston, VA. Water Resources Div.
R. E. Fish, and F. T. Schaefer.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of the Water Resources Planning and Management Irrigation and Drainage Divisions, Virginia Polytechnic Institute, Blacksburg, Virginia, July 26-28, 1978. 15 p, 4 fig, 9 ref.

Descriptors: *Delaware River Basin Commission, *Interstate commissions, *Water management(Applied), *Regulation, *Reviews, Institutions, Water supply, Water distribution(Applied), Diversion, Administration, Delaware, Maryland, New Jersey, New York.

Attempts to negotiate interstate compacts for utilizing Delaware River water began in 1925. These negotiations failed. The State and city of New York then proceeded with plans for storage and diversion. The plans were opposed by New Jersey, which sought relief before the Supreme Court of the United States. Pennsylvania intervened, and a decree apportioning the waters was handed down in 1931. The matter was reopened in 1952, with Delaware also intervening, and an amended decree was entered in 1954, setting forth diversion limitations and in-stream flow requirements and establishing a River Master to oversee compliance. In 1961 a Federal-interstate compact was adopted, and the Delaware River Basin Commission came into existence. The Commission was granted broad powers but was enjoined from interfering with operations under the amended decree except under conditions of drought or catastrophe. (Woodard-USGS)
W79-04804

FLOOD PLAIN INFORMATION: BIG THOMPSON RIVER, WELD COUNTY, COLORADO,
Army Engineer District, Omaha, NE.
For primary bibliographic entry see Field 2E.
W79-04854

FLOOD PLAIN INFORMATION: TCHEFUNCTA RIVER AND TRIBUTARIES, COVINGTON, LA.
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W79-04855

THE RIVER'S REACH: A UNIFIED PROGRAM FOR FLOOD PLAIN MANAGEMENT IN THE CONNECTICUT RIVER BASIN.
New England River Basins Commission, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 079, Price codes: A15 in paper copy, A01 in microfiche. December 1976. 292 p, 33 fig, 42 tab, 7 appendices.

Descriptors: *Rivers, *River beds, *Floodways, *Flood plains, *Flood plain insurance, Warning systems, *New England, *Connecticut River, *Flood plain management, Floods, Flooding, Historic Floods, Flood data, Flood damage, *Flood protection, Flood plain zoning, Building codes, Land use, Planning, Zoning, Control structures, Dikes, Dams, Reservoirs, Water storage, Floodproofing, Water quality, Cost-benefit analysis, Environmental effects, Connecticut, New Hampshire, Vermont, Massachusetts, Recreation, Fish and Wildlife, Governments, Coordination.

This report was written to help communities in 4 New England states reduce over $15 million in average annual flood damages. The major objectives of the study are: to prevent loss of life; to effect wise choice among competing uses of flood plains; to reduce the potential for damage for existing development in flood hazard areas; and to prevent damages from increasing. Floods in the Connecticut River Basin are caused by rainfall and snowmelt. Two severe floods occurred in 1936 and 1938; since that time flood control structures have been constructed. In spite of these preventive measures, with increasing urbanization flood damage losses are increasing. Two strategiescan be used to reduce flood damages; a flood reduction strategy and an implementation strategy. Major flood projects of 6 cities are analyzed. The flood modification alternatives of reservoirs, dike raising, and non-structural approaches are examined and all three recommended in various drainage basins of the area. A cost-benefit analysis is presented and environmental and water quality impacts for recreation, fish and wildlife, and historic sites are discussed for the individual reservoirs. Local structural options are presented for 3 of the watersheds. A detailed discussion on how to modify susceptibility to flooding includes discussions on nonstructural options, with conclusions and recommendations included for each method. Coordination, communication, and cost sharing are discussed with recommendations for government and local agency coordination, federal financial support, cost-sharing agreements and unified program agreement between the four states. An environmental impact statement for the Unified Program is presented as one of the appendices. (Arnold-NC)
W79-04857

FLOOD HAZARD ANALYSES: WASHITA RIVER, RAINY MOUNTAIN CREEK, MOUNTAIN VIEW AND VICINITY, KIOWA COUNTY, OK.
Soil Conservation Service, Stillwater, OK.
For primary bibliographic entry see Field 2E.
W79-04860

FLOOD PLAIN INFORMATION: CALCASIEU RIVER, OAKDALE, LOUISIANA,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W79-04861

FLOOD HAZARD STUDY: BARK RIVER, VILLAGE OF DOUSMAN AND VICINITY, WAUKESHA COUNTY, WISCONSIN.
Soil Conservation Service, Madison, WI.
For primary bibliographic entry see Field 2E.
W79-04863

SPECIAL FLOOD HAZARD INFORMATION: FRANKLIN, LOUISIANA AND VICINITY, YOKELY BAYOU AND BAYOU TECHE.
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W79-04864

FLOOD PLAIN INFORMATION: SALT CREEK - VICINITY OF PUEBLO, COLORADO.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W79-04865

FLOOD HAZARD ANALYSES: MCKENZIE RIVER, HEDRICKS BRIDGE TO LEABURG DAM, LANE COUNTY, OREGON.
Soil Conservation Service, Portland, OR.
For primary bibliographic entry see Field 2E.
W79-04866

PLANNING STATUS REPORT: WATER RESOURCE APPRAISALS FOR HYDROELECTRIC LICENSING--LOWER WHITE RIVER BASIN, MISSOURI-ARKANSAS.
Federal Energy Regulatory Commission, Washington, DC. Bureau of Power.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 009, Price codes: A02 in paper copy, A01 in microfiche. Originally issued 1965, revised 1977. 16 p, 2 fig, 5 tab.

Descriptors: *Water resources planning, *Reservoirs, *Water quantity management, *Hydroelectric power, *Hydroelectric project licensing, *Water resources management, *White River Basin(MO & AR), *Lower White River Basin(MO & AR), River basins, Flood control, Groundwater, Thermal power, Electric powerplants.

This report is one of a series of revised Planning Status Reports for major river basins in the U.S. The purpose of the reports is to provide up-to-date information on water resources for use by the Federal Power Commission, and they present data on existing and potential water resource developments and on water use by existing and projected thermal generating facilities. This report covers the Lower White River Basin of Southeastern Missouri and East Central Arkansas. The basin, a drainage area of 17,893 square miles, contains three hydroelectric-flood control structures with a combined installed capacity of 532,000 kilowatts, and four fossil fueled steam electric plants with a total generating capacity of 1,390,000 kilowatts. Potential water resource developments in the Basin include six conventional reservoirs with a combined storage capacity of 327,000 kilowatts and four pumped storage projects with a combined storage capacity of 4,300,000 kilowatts. Five flood control reservoirs projected to store a capacity of 2,180,000 area feet of water are planned. Estimated generating capacities from steam electric plants are projected to be 1,390,000 kilowatts (for 1985) and 4,724,000 kilowatts (for 2000). Proposed further studies for land and water resource uses should include fish and wildlife enhancement irrigation and drainage, forest conservation, soil and water conservation, recreation, and increased navigation and flood control. (Arnold-NC)
W79-04872

PLANNING STATUS REPORT: WATER RESOURCE APPRAISALS FOR HYDROELECTRIC LICENSING--UPPER WHITE RIVER BASIN, MISSOURI AND ARKANSAS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 010, Price codes: A02 in paper copy, A01 in microfiche. Originally issued 1965; revised 1977. 13 p, 2 fig, 3 tab.

Descriptors: *Water resources planning, *Reservoirs, *Water quantity management, *Hydroelectric power, *Hydroelectric project licensing, *Water resources development, *White River Basin (MO & AR), *Upper White River Basin(MO & AR), River basins, Flood control, Groundwater, Thermal power, Electric powerplants.

This report is one of a series of revised Planning Status Reports for major river basins in the U.S. The purpose of the report is to provide up-to-date information on water resources for use by the Federal Power Commission, and they present data on existing and potential water resource develop-

ments, and on water use by existing and projected thermal generating facilities. This report covers the Upper White River Basin of the Southwestern Missouri and Northwestern Arkansas Ozark Region. The basin, a drainage area of 9,872 square miles, contains five hydroelectric flood control structures with a combined installed generating capacity of 738,000 kilowatts. Potential water resource developments include six hydroelectric projects with a planned installed generating capacity of 341,000 kilowatts; planned generating capicity for steam electric plants in the Basin is projected at 707,000 kilowatts for 1985 and 7,157,000 kilowatts for the year 2000, including proposed nuclear capacity of 6,000,000 kilowatts, using dry towers for cooling. The Corps of Engineers has been studying the advisability of providing additional measures for flood control, regional and agricultural water supply, hydroelectric power, recreation, fish and wildlife and other related water and land resources. (Arnold-NC)
W79-04873

FLAT CHANNEL TERRACES FOR POLLUTION ABATEMENT AND SEDIMENT CONTROL,
Soil Conservation Service, Grand Island, NE.
H. G. Buchta, W. W. Liesemeyer, and L. G. Jackson.
Paper No. 78-2521, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 5 p. 1 fig, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Terracing, Pollution abatement, *Sediment control, Runoff, Crop production, Semiarid climates, Computer programs, Diversion, Gullies, Nebraska.

Flat channel terraces have been effectively used to control and use runoff water. The runoff can help stabilize crop production in a semiarid climate. Parallel flat channel terraces are growing in popularity. (Skogerboe-Colorado State)
W79-04914

PARALLEL TERRACES ON FLAT SLOPES,
Agricultural Research Service, Big Spring, TX.
D. W. Fryrear, and E. Archer.
Paper No. 78-2522, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 15 p, 2 fig, 1 tab, 8 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Terracing, Slopes, *Slope stabilization, Soil conservation, Water conservation, Crop production, Dry farming, Texas, Runoff.

West Texas has more terraces constructed each year than most states. This manuscript describes the design, layout, and construction of parallel terracing systems in this part of the state. Several farmers were interviewed concerning their feelings about parallel terraces and why they are used on their farms. The farmers are enthusiastic with the benefits of terraces particularly if they are involved in the design and construction of the system. Despite the point rows, more skilled operators, and increased time in the field, some producers feel that the increased production from terraced fields will pay for the construction costs in four to five years. (Skogerboe-Colorado State)
W79-04915

INTERCEPTOR DRAINS ON SLOPING LAND,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
R. Gharaaty-Sani, and L. G. King.
Paper No. 78-2038, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 21 p. 11 fig, 2 tab, 21 ref. ASAE, St. Joseph, Michigan.

Descriptors: Subsurface drains, *Subsurface drainage, Interception, Canal seepage, Steady flow, Numerical analysis, Seepage, Flow rates, Water table.

A single subsurface drain intercepting seepage from an upslope source such as a canal was studied under steady flow conditions. Numerical methods were used to solve the nonlinear partial differential equation describing the two-dimensional problem with both partially and fully saturated flow occurring. Three different soils and three different depths of water in the canal were studied using this model. The resulting water table and drain discharge were compared with published theory based upon laboratory flume studies which neglected or minimized partially saturated flow. The published theory predicts water table shape and location adequately for design purposes; however, the drain discharge given by such theory is low (sometimes for fine textured soils, as low as fifty percent of that given by this study). Neglecting partially saturated flow could lead to undersized drains on sloping lands. (Skogerboe-Colorado State)
W79-04916

DEPOSITION OF NONUNIFORM SEDIMENT ON CONCAVE SLOPES,
Purdue Univ., Lagayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W79-04917

WALNUT CREEK CHANNEL IMPROVEMENT PROJECT, CONTRA COSTA COUNTY, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2E.
W79-04923

PROCEEDINGS, RESEARCH PLANNING CONFERENCE ON THE AQUATIC PLANT CONTROL PROGRAM, 3-7 OCTOBER 1977.
Army Engineer Waterways Experiment Station, Vicksburg, MS.
Miscellaneous Paper A-78-1, August 1978. 267 p, 1 append.

Descriptors: *Aquatic weed control, *Aquatic plants, *Planning, Conferences.

The 12th Annual Meeting on the U.S. Army Corps of Engineers Aquatic Plant Control Research Program was held in New Orleans, La., on 3-7 October 1977 to review current operations activities and to afford an opportunity for presentation of current research projects. (WES)
W79-04932

MINIMIZING SALT IN RETURN FLOW THROUGH IRRIGATION MANAGEMENT.
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 3F.
W79-04996

4B. Groundwater Management

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN DAWSON AND BORDEN COUNTIES, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-04576

MANAGING THE LOW-YIELD WATER WELL,
Hydrodyne Development Co., Forestville, CA.
M. Fisher.
Pacific Groundwater Digest, Vol. 2, No. 1, p 21-28, January, 1979. 1 fig.

Descriptors: *Water supply, *Water wells, *Water management, *Water yield, Water utilization, Pumping, Control systems.

The problems of low-yield wells in relatively impermeable aquifer material can be managed with periodic service maintenance. It is possible to design a reliable system that will make a one-half gpm well into a 720 gpd water supply which will be more than adequate for domestic water uses. The installation and maintenance of water systems with low-yield wells requires skilled and experienced mechanics. A pump can be prevented from running dry or gulping air with a control which integrates an air line, a direct-acting sensitive pressure-responsive switch and a small electric air pump. This control keeps the pump off till the well has recovered 6 feet. For wells that may not have even a 6 foot total recovery a different control is available which can be adjusted to work at differentials of from 4 inches to 18 inches. The air line can be disconnected from the control and used to feed water conditioning chemicals into the well. The design and operation of a water system with very low-yield wells is described in some detail along with a diagram showing the key components of the system. (Purdin-NWWA)
W79-04580

FIELD EVALUATIONS OF GROUNDWATER CONTROL BY TRENCH AND TRENCHLESS METHODS OF INSTALLED DRAINS--LOWER RIO GRANDE VALLEY OF TEXAS,
Soil Conservation Service, Temple, TX.
G. C. Vittetoe, and B. J. Garner.
Paper No. 78-2043, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 6 p. 7 fig. ASAE, St. Joseph, Michigan.

Descriptors: *Subsurface drainage, Subsurface drains, Drainage practices, Trenches, Salinity, Flow rates, Water quality control, Texas, Groundwater management.

Results are presented of field evaluations of the flow performance of 209 subsurface drainage systems in the Lower Rio Grande Valley of Texas. These drain systems are installed to control groundwater and serve as artificial subsurface drainage arteries for salinity management in an irrigated area. Of the 209 examined installations, 141 were installed by the trench method and 68 by the trenchless method. All systems were installed in calendar years 1975 and 1976, and all utilized perforated corrugated plastic tubing, of 4- to 6-inch diameter size, and nylon fabric filters. The evaluations reveal the ability of the 209 drain systems to discharge flow in the presence of a groundwater flow source, with the surface of the groundwater variously ranging from 2 to 6 feet below the ground surface. The data displays a strong general disparity in the unit flow for systems installed by the trench and trenchless methods, with the trench method showing a noticeably higher flow performance for seemingly similar conditions. In repeated instances, the flow performances of systems installed by the trenchless method were less than that believed to be needed to satisfy minimal drainage coefficients for the area. (Skogerboe-Colorado State)
W79-04906

PRELIMINARY ASSESSMENT OF POLICY AND MANAGEMENT OPTIONS FOR GROUNDWATER MINING IN THE GREAT PLAINS,
Kansas Water Resources Research Inst., Manhattan.
F. Keller, G. Heatwole, and J. Weber.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292-969, Price codes: A10 in paper copy, A01 in microfiche. Contribution No. 204, February 1979. 106 p, 23 fig, 41 tab, 95 ref, append. OWRT B-046-KAN (2), 14-34-0001-6080.

Descriptors: *Groundwater mining, Kansas, Colorado, Nebraska, Aquifer Management, Groundwater management, Policy, Decision making, Ogallala aquifer.

This project examined the viability of groundwater management districts in those parts of the high

plains experiencing groundwater mining. Specifically the project focused on the states of Kansas, Colorado and Nebraska, especially the portions underlain by the Ogallala Aquifer. The districts were studied through field research and a mail survey utilizing a thirteen page questionnaire. The field research was conducted in four states and districts were surveyed in five states. Analysis of the data indicated districts were willing to implement policies such as well spacing and metering but that any regulation beyond these policies will be at best not opposed.
W79-04957

MATHEMATICAL METHODS FOR ANALYSIS OF FRESH WATER LENSES IN THE COASTAL ZONES OF THE FLORIDAN AQUIFER,
Florida Univ., Gainesville. Water Resources Research Center.
B. A. Christensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 067, Price codes: A09 in paper copy, A01 in microfiche. Publication No. 44, 1978. 171 p, 53 fig, 1 tab, 68 ref, 5 append. OWRT A-032-FLA(1), 14-34-0001-8010.

Descriptors: *Groundwater, *Aquifers, Florida, *Artificial recharge, Numerical model, Model studies, *Sea water intrusion, Water table, Injection wells.

Concentrated land development in Florida's coastal regions often leads to saltwater intrusion in coastal aquifers. It has been proposed that excess freshwater could be artificially recharged to these coastal aquifers in order to drive out the intruded saltwater by the formation of a freshwater lens. The purpose of this study is to develop methods for analyzing this process. A numerical model based on the finite element method is developed by which the boundaries of a growing freshwater lens can be traced in two horizontal dimensions. This model simulates the injection of freshwater through multiple wells into a thin confined or leaky saline aquifer in which there may be a pre-existing head gradient. The use of the model is demonstrated by application to the peninsula of Pinella County, Florida. A case study concerning a South Florida retirement community illustrates the hydrologic analysis of developed land constructed by dredging and filling. Field data was collected, interpreted and used in a numerical model which simulates interaction between the dredged canals and the water table in the reclaimed land. Finally, a numerical scheme using the method of characteristics is developed to predict the movement in the vertical plane of the interface at the boundary of a freshwater lens in a saline aquifer. (Heaney-Fla)
W79-04961

SUBSURFACE DRAIN SPACING FROM WATER TABLE AND OUTFLOW MEASUREMENTS,
Ohio Agricultural Research and Development Center, Columbus. Dept. of Agricultural Engineering.
D. W. Michener, G. O. Schwab, R. W. Skaggs, J. D. Gordos, and C. J. Olosky.
Paper No. 78-2536, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 12 p. 2 fig, 8 tab, 6 ref. ASAE, St. Joseph, Michigan.

Descriptors: Subsurface drains, *Subsurface drainage, Water table, Drawdown, Hydraulic conductivity, Porosity, Discharge measurement, Soil texture, Statistical methods.

Hydraulic conductivity and drainable porosity were determined from water table drawdown and outflow measurements for six fine-textured soils in Ohio. Drain spacings were computed for three drawdown rates with a coefficient of variation of about 30%. When drawdown was corrected for evapotranspiration, spacings were reduced about 16%. (Skogerboe-Colorado State)
W79-04986

ANALYSIS OF COMBINATION SURFACE-SUBSURFACE DRAINAGE SYSTEMS FOR HUMID REGION SOILS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. W. Skaggs.
Paper No. 78-2541, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 16 p, 13 fig, 5 tab, 20 ref. ASAE, St. Joseph, Michigan.

Descriptors: Surface drainage, Subsurface drainage, *Drainage systems, Simulation analysis, Trafficability, Humid climates, Model studies, Crop production.

Various designs of combination surface-subsurface drainage systems were analyzed by simulating their performance over twenty-five years of climatological record. Simulations were conducted and results analyzed for 4 soils at 3 locations: Jacksonville, Florida, Wilmington, North Carolina, and Columbus, Ohio. (Skogerboe-Colorado State)
W79-04989

INCORPORATING CROP NEEDS INTO DRAINAGE SYSTEM DESIGN,
Castle and Cooke, Inc. (Honduras).
C. J. Ravelo, D. L. Reddell, E. A. Hiler, and R. W. Skaggs.
Paper No. 78-2540, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 20 p, 7 fig, 3 tab, 24 ref.

Descriptors: Drainage practices, *Drainage systems, Computer models, Water table, Soil water, Soil-water-plant relationships, Simulation analysis, Crop production.

An improved approach is proposed for incorporating crop drainage requirements into drainage design procedures. The overall methodology links crop drainage requirements, climatological data, and drainage theory into a workable design method through incorporation of the stress-day index concept into a water management model. (See W77-05983) (Skogerboe-Colorado State)
W79-04998

4C. Effects On Water Of Man's Non-Water Activities

LONG-TERM PATTERNS OF SEDIMENT PRODUCTION FOLLOWING ROAD CONSTRUCTION AND LOGGING IN THE OREGON COAST RANGE,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
For primary bibliographic entry see Field 2J.
W79-04750

AN EVALUATION OF THE EFFECTS OF GEOTHERMAL ENERGY DEVELOPMENT ON AQUATIC BIOTA IN THE GEYSERS AREA OF CALIFORNIA,
California Univ., Berkeley. Div. of Entomology and Parasitology.
For primary bibliographic entry see Field 6G.
W79-04962

4D. Watershed Protection

CORN RESIDUE MANAGEMENT TO REDUCE EROSION IN IRRIGATION FURROWS,
Science and Education Administration, Prosser, WA. Agricultural Research.
J. S. Aarstad, and D. E. Miller.
Journal of Soil and Water Conservation, Vol. 33, No. 6, p 289-291, November-December 1978. 5 tab, 4 ref.

Descriptors: *Erosion control, *Furrow irrigation, *Farm management, On-site investigations, Crops, Corn, Irrigation, Sediments, Turbidity, Runoff, Infiltration, Erosion, Agriculture, *Tillage practices, Crop residues.

Three tillage systems--clean tillage, disking, and till-planting, including furrowing--were evaluated to determine the effects of corn residues on furrow erosion, runoff water turbidity, and infiltration rates under furrow irrigation on medium-textured soils. Disking and till-planting left corn residue in the irrigation furrows. This essentially eliminated soil erosion and increased infiltration rates compared with clean tillage. Tail-water leaving the trashy furrows was often less turbid than that entering the field. Surface residues did not affect corn yields adversely. (Sims-ISWS)
W79-04724

ECONOMICS OF ON-FARM METHODS OF CONTROLLING SEDIMENT LOSS FROM SURFACE-IRRIGATED FIELDS,
L. R. Conklin, K. H. Lindenborg, E. L. Michalson, and R. B. Long.
The Journal of Soil Science (Idaho Agricultural Experimental Station Bulletin), Vol. 29, No. 3, p 1-23, September 1978. 8 fig, 28 tab.

Descriptors: *Costs, *Surface irrigation, *Soil erosion, *Methodology, *Soil management, *Sedimentation ponds, Vegetative strips, Sprinkler irrigation, Settling basins, Farm ponds, Irrigation, Economics, Idaho, Magic Valley(ID), Boise Valley(ID), Sediments, Sedimentation, Soil conservation, Farm management, Crop production, Valleys, Crops, Cost-effectiveness, Model studies, Water pollution control, Flow cutback.

Sediment losses in the Magic and Boise Valleys of southern Idaho could be reduced 50-66% at modest cost; the finding is based on evaluation of five reduction methods weighed against farm income considerations. Losses can be reduced using on-farm sediment ponds dug into a waterway, or vegetative buffer strips for grain. Ponds would cost an average of $475 annually on small farm models and $950 annually on large farm models. Net returns to land and management with the ponds are reduced slightly over 1%. Compared with sediment ponds, minibasins on the lower end of a field increase sediment retained on model farms for all crops except potatoes, but increase costs. For both farm model sizes, minibasins reduce average sediment loss by 82%; for small farm models sediment losses of 500 tons are reduced to 90 tons, and for large models from 1000 to 185 tons. Average annual costs are $1000 and $2175 respectively, and net returns to land and management are lowered by slightly over 2.5%. Elimination of surface runoff and sediment losses would require sprinkler irrigation, which would cost an average of $5650 on small farm models and $11,600 on large farm models, and decrease net returns to land and management by about 15% in both cases. Flow cutback was the most expensive method as it reduced sediment loss by only 30%. (Lynch-Wisconsin)
W79-04756

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DISTRIBUTION OF STABLE ORGANIC MOLECULES IN THE MARINE ENVIRONMENT: PHYSICAL CHEMICAL ASPECTS. CHLORINATED HYDROCARBONS,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5C.
W79-04559

VOLATILE LIQUID HYDROCARBONS IN THE SURFACE COASTAL WATERS OF THE GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of Oceanography.

For primary bibliographic entry see Field 5C.
W79-04560

NUTRIENT BUDGET FOR A RESIDENTIAL STORMWATER CATCHMENT IN DURBAN, SOUTH AFRICA,
National Inst. for Water Research, Congella (South Africa). Regional Lab.
For primary bibliographic entry see Field 5B.
W79-04565

DETERMINING NUTRIENT LOADING FROM RAINFALL AND RUNOFF IN SMALL RIVERS,
Technische Univ., Hanover (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
For primary bibliographic entry see Field 5B.
W79-04566

URBAN RUNOFF FROM A ROAD SURFACE--A WATER QUALITY STUDY,
Imperial Coll. of Science and Technology, London (England).
For primary bibliographic entry see Field 5B.
W79-04567

ATMOSPHERIC FALLOUT AND STREET CLEANING-EFFECTS ON URBAN STORM WATER AND SNOW,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Water Supply and Sewerage.
For primary bibliographic entry see Field 5B.
W79-04568

NITRATES IN WATER SUPPLY ABSTRACTIONS IN THE ANGLIAN REGION: CURRENT TRENDS AND REMEDIES UNDER INVESTIGATION,
Anglian Water Authority (England). Public Health and Water Supplies.
L. A. Greene.
Water Pollution Control, Vol 77, No 4, p 478-491, 1978. 7 fig, 3 tab, 11 ref.

Descriptors: *Nitrates, *Water supplies, *Rivers, *Groundwater, Surveys, Nitrogen, Water pollution, Fertilizers, Sewage effluents, Potable water, Water treatment, Water resources, Water chemistry, Water quality, Water quality standards, Water pollution control, *England, Pubic health.

Existing reports indicated that prior to the formation of the regional water authorities in 1974, a number of groundwater sources in the Anglian region possessed nitrate concentrations in excess of the World Health Organization recommended level for drinking water. A regional survey in 1975 indicated that 50 public supply boreholes, wells, and springs accounting for about 160 tcmd had recorded nitrate levels in excess of 11.3 mg/l (as nitrogen); 12 of these sources had recorded levels in excess of 15 mg/l nitrate-N. The major 'problem' abstractions were identified in the East Anglian chalk aquifers and the Lincolnshire limestone. Lack of data on many groundwater sources prevented a fully comprehensive survey of all public-supply groundwater abstractions being carried out at that time. Additionally, the regional survey indicated that prior to 1974, 445 tcmd of surface-derived supplies had exceeded 11.3 mg/l nitrate for brief periods; about 15% (by volume) were direct river abstractions and the remainder were pumped storage impoundment intakes. In this latter situation it was noted that nitrate concentrations in impoundments were reduced by 40-50% as assessed on the basis of annual maximum and minimum concentrations at the point of abstraction. One small direct river abstraction supply in Suffolk, located in a wholly agricultural catchment with no sewage effluent discharges, was found to have consistently contained more than 11.3 mg/l nitrate-N for a number of years. (Sims-ISWS)
W79-04570

KINETIC ANALYSIS OF INTERACTIVE EFFECTS OF CADMIUM AND NITRATE ON GROWTH OF THALASSIOSIRA FLUVIATILIS (BACILLARIOPHYCEAE),
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
W. K. W. Li.
Journal of Phycology, Vol. 14, p 454-460, 1978. 2 tab, 6 fig, 30 ref.

Descriptors: *Cadmium, *Metals, Water pollution effects, *Bioassay, Laboratory tests, Growth rates, *Growth kinetics, Sea water, *Nitrates, Isochrysis, Thalassiosira, Nutrients, Growth inhibition.

The effect of cadmium on growth rates of Thalassiosira and Isochrysis at non-limiting nutrient concentrations is described by the Lerusalimskii equation. At limiting nitrate concentrations, the effect of Cd on growth rate of T. fluviatilis is described by analogy to the general equation of enzyme inhibition in which the reaction involves a single intermediate. When cells are stressed by Cd, not only is the maximum growth rate reduced, but the half-saturation growth parameter is increased. Results show that for T. fluviatilis, the degree of inhibition by Cd is more severe at low than at high NO3 levels but the difference in severity diminishes as Cd concentration increases. (Katz-EIS)
W79-04587

THE UPTAKE AND RELEASE OF PETROLEUM HYDROCARBONS BY THE MARINE MUSSEL MYTILUS EDULIS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
N. Hansen, V. B. Jenson, H. Appelquist, and E. Morch.
Progress in Water Technology, Vol. 10, No. 5-6, p 351-359, 1978. 2 fig, 2 tab, 26 ref.

Descriptors: *Mussels, *Oil, *Absorption, Aromatic compounds, Organic compounds, Oil pollution, Radioactivity techniques, Tracers, Animal metabolism, Animal physiology, Path of pollutants, Lipids, Carbon radioisotopes, *Bioaccumulation, *Tissue analysis, *Naphthalene, *Toluene, *Depuration.

Mussels were exposed to seawater solutions of four radiolabelled hydrocarbons. The aromatic hydrocarbons were rapidly accumulated. Bioaccumulation factors were determined to about 4 for toluene, about 30 for naphthalene, and more than 70 for phenanthrene. The bioaccumulation factors were found independent of the water concentration level. When transferred to clean seawater the hydrocarbons were released, toluene and naphthalene very rapidly, phenanthrene more slowly. Hexadecane was taken up and released very slowly. During 8 hours' exposure to hexadecane the concentration in the mussels did not reach the concentration in the water. The coefficients of variation of hydrocarbon accumulation between individual mussels were determined and found between 18 and 32%. The results support the theory that uptake and release of hydrocarbons are passive processes dependent or partitioning between the water and the tissue lipids. (DEAL-EIS)
W79-04588

CONTENTS OF TOTAL MERCURY, ALKYL MERCURY, AND METHYL MERCURY IN SOME COASTAL FISH AND SHELLS,
Yamaguchi Prefectural Research Inst. of Health (Japan).
H. Kumagai, and K. Saeki.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 7, p 807-811, 1978. 2 fig, 5 tab, 26 ref.

Descriptors: *Mercury, *Shellfish, *Analytical techniques, Heavy metals, Chemical analysis, Path of pollutants, Water quality, Pollutant identification, Crustaceans, Gastropods, Aromatic compounds, Organic compounds, Fish physiology, *Methylmercury, *Alkyl mercury, *Mercury compounds, *Tissue analysis.

This investigation was conducted in an attempt to clarify the levels of total, alkyl, and methyl mercuries in the fish and shells caught in coastal waters where mercurial pollution was not assumable. The development of analytical procedures for mercury determination made it possible to conduct an extensive survey of the mercury distribution in the fish and shells available at Yamaguchi and adjacent waters. The results obtained are as follows: (1) The results of the analysis for total mercury were that mean values of 0.069, 0.078, 0.058, and 0.041 ppm were obtained in the edible portions of fish, crustacean, cephalopod, and bivalve and gastropod groups respectively, with wide within-group variation. (2) No lower alkyl mercuries, except methyl mercury, were detected in any of the samples. It is conceivable, therefore, that the content of lower alkyl mercury coincides with that of methyl mercury when the sample is obtained from coastal waters probably uncontaminated with mercury. Mean values of methyl mercury in the edible portion of the four above-mentioned groups were 0.046, 0.009, 0.025, and 0.008 ppm respectively. (3) the mean ratios of methyl mercury to total mercury in the edible portion of the four groups were 0.67, 0.46, 0.70, and 0.18 respectively. (Deal-EIS)
W79-04589

PHYTOPLANKTON ECOLOGY OF VANCOUVER HARBOR,
Fisheries and Marine Service, Vancouver (British Columbia). Dept. of Fisheries and Ocean.
For primary bibliographic entry see Field 5B.
W79-04617

NO. 2 FUEL OIL DECREASES EMBRYONIC SURVIVAL OF GREAT BLACK-BACKED GULLS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5C.
W79-04628

INCREASED SPONTANEOUS LOCOMOTOR ACTIVITY IN THE FIDDLER CRAB, UCA PUGILATOR, AFTER EXPOSURE TO A SUBLETHAL CONCENTRATION OF DDT,
Tulane Univ., New Orleans, LA. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-04629

BIOLOGICAL SURVEILLANCE OF RIVERS: A BIOLOGICAL MONITORING HANDBOOK,
Water Pollution Research Lab., Stevenage. (England).
For primary bibliographic entry see Field 7B.
W79-04634

A COLORIMETRIC ANALYSIS FOR ABIETIC-TYPE RESIN ACIDS IN PULPING EFFLUENTS,
MacMillan Bloedel Ltd., Vancouver (British Columbia).
K. L. McDonald.
Tappi, Vol. 61, No. 10, p 77-79, October, 1978. 1 fig, 9 ref.

Descriptors: *Pulp wastes, *Resin acids, *Waste identification, Abietic acids, Organic acids, Wastes, Industrial wastes, Water pollution sources, Colorimetry, Analytical techniques, Pulp and paper industry, Effluents, Toxicity, Canada, Foreign countries, Kraft mills.

At MacMillan Bloedel Research Ltd. (Vancouver, Canada), resin acids in kraft pulp mill effluents were recovered by solvent extraction and quantitatively determined using a colorimetric technique in which abietic acid in alkaline solution is reacted with a diazonium salt, viz., 1-amino-2-naphthol-4-sulfonic acid. Recovery was not quantitative but could be calculated for a given set of conditions and the analytical results adjusted accordingly. Quantities of less than 1 ppm of resin acids were determined with a +12% relative standard deviation at the 10-ppm level. The effect of interference by unsaturated acids and sterols was not severe, and stability of the developed color was better than in the current Carpente: procedure; cf. Tappi, Vol. 48, No. 11, p 669-671, 1965. The 2-

amino-2-methyl-1-propanol salt of levopimaric acid is recommended as a stable resin acid standard. (Switchtenberg-IPC)
W79-04636

A COMPUTER MONITORED AQUATIC BIOASSAY SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
K. W. Thompson, K. L. Dickson, D. Hooley, J. Cairns, Jr., and W. H. Van der Schalia.
In: Proceedings of the Tenth Mid-Atlantic Industrial Waste Conference, p 61-66, 1978. J. B. Carberry, Ed. University of Delaware. 7 fig, 9 ref.

Descriptors: *Fish behavior, *Research equipment, *Bioassay, Respiration, Monitoring, Fish physiology, Electrical equipment, Toxicity, Automatic control, Computers, Data collections, Sunfishes.

Increased use of aquatic resources and related legislation have led to elevated demands for bioassay information. The need to produce large amounts of reliable bioassay data is facilitated by the utilization of available electronic technology since it reduces costs and makes the handling of large amounts of data feasible. An electronic system which can detect the action potential generated by muscle activity in the branchial region of a fish during ventilatory activity is reported. This equipment facilitates the monitoring of the sub-lethal effects of toxicants on ventilatory behavior. (Deal-EIS)
W79-04652

STUDIES ON THE POST-MORTEM IDENTIFICATION OF THE POLLUTANT IN FISH KILLED BY WATER POLLUTION - XIII CADMIUM (IN JAPANESE),
Tohoku Univ., Sendai (Japan). Dept. of Fisheries.
T. Kariya, H. Haga, Y. Haga, and Y. Kawasaki.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 10, p 1065-1072, 1978. 4 fig, 8 tab, 7 ref. (English abstract).

Descriptors: *Bioassay, *Toxicity, *Cadmium, *Mortality, Metals, Lethal limit, Laboratory tests, Path of pollutants, Absorption, Industrial wastes, Heavy metals, Pollutants, Water pollution sources, Freshwater fish, *Bioaccumulation, *Carassius, Tissue analysis, Cadmium plating, Cadmium compounds.

The toxicity of several cadmic solutions to fishes and cadmium content in fish bodies killed with these solutions were investigated. The 48 h TLm values for goldfishes for CdCl2, Cd(CN)2, and Cd-plating solution III were 5 to 10 ppm Cd and those for Cd-plating solutions I and II were approximately 0.3 ppm Cd. Thus, the latter is more toxic than the former. These latter solutions had toxicities greater than that indicated by CN concentration in them. Greater fish mortality and cadmium content in fish bodies were observed for non-feeding group than for feeding group, in CdCl2 solution containing 0.1 ppm of Cd which is considered to be at the semi-acute level. Cadmium concentration was higher in hepatopancreas than in kidneys for the feeding group and vice versa for the non-feeding group. The analysis of whole fish bodies revealed large cadmium contents for the fishes killed with CdCl2, Cd(CN)2, and Cd-plating solution III; for the fishes killed with Cd-plating solutions I and II, high cadmium content was observed only in the case of larger cadmium concentration in those solutions. (Katz-EIS)
W79-04694

AN AUTOMATED DEVICE (AGARS) FOR STUDYING AVOIDANCE OF POLLUTANT GRADIENTS BY AQUATIC ORGANISMS,
University of West Florida, Pensacola. Faculty of Biology.
C. R. Cripe.
Available from the National Technical Information Service, Springfield, VA 22161 as Journal of the Fisheries Research Board of Canada, Vol. 36, No. 1, p 11-16, 1979. 3 fig, 14 ref.

Descriptors: *Bioassay, *Laboratory tests, Laboratory animals, Monitoring, *Methodology, *Chlorine, Fish behavior, Fish physiology, Avoidance responses, Behavioral bioassays, Toxicity, Gradients, Chlorination, Lagodon, Aquatic gradient avoidance response system, Chlorine produced toxicants.

Most apparatus designed to detect avoidance of pollutants by aquatic organisms require visual observations of test organisms in steep pollutant gradients. AGARS (Aquatic Gradient Avoidance Response System) was developed to eliminate these limitations. This system allows animals to choose between one uncontaminated zone and three increasingly toxic zones in a gradient trough that is monitored for extended time periods by infrared light sources, sensors, and a microprocessor. Data are accumulated hourly and processed by a paper tape reader/calculator/plotter system that records the time test animals remain in each zone and compares behavior before and during test exposures. Initial tests indicate that pinfish (Lagodon rhomboides) tested in the apparatus will avoid chlorine-produced oxidants at concentrations of 0.02-0.04 mg/L. (Katz-EIS)
W79-04696

A GEOGRAPHICALLY VARIABLE WATER QUALITY INDEX USED IN OREGON,
Oregon Dept. of Environmental Regulation, Salem. Water Quality Div.
D. A. Dunnette.
Journal of the Water Pollution Control Federation, Vol. 51, No. 1, p 53-61, January 1979. 7 fig, 4 tab, 23 ref.

Descriptors: *Water quality index, *Water quality criteria, *Regions, *Planning, *Oregon, Basins, Streams, Mathematical models, Systems analysis, Seasonal variations, Willamette River basin(Ore), Parameter selection, Aggregation.

An Oregon Water Quality Index has been developed which takes into consideration differences in water quality resulting from geographical characteristics of separate basins. The index was developed for the purpose of providing a simple, concise, and valid method for expressing the significance of regularly generated laboratory data. The trend-monitoring value of the index was demonstrated for two quite different Willamette River stations. Correlations among this and several other proposed indexes averaged 0.87. Yearly and seasonal variations in water quality were quantitized and found to average 88.9 and 78.9 Oregon Water Quality Index units for the higher and lower water quality stations respectively over the period 1971-1976. Calculated rates of change in water quality were +0.68 and +0.91 Oregon Water Quality Index units/year for the two stations for 1971-1976. The Oregon Water Quality Index is now used routinely in that state's primary station sampling program to recognize water quality trends. (Bell-Graf-Cornell)
W79-04697

COMPARISON OF A HIGH VOLUME PUMP AND CONVENTIONAL PLANKTON NETS FOR COLLECTING FISH LARVAE ENTRAINED IN POWER PLANT COOLING SYSTEMS,
Lockheed Center for Marine Research, Carlsbad, CA.
R. M. Leithiser, K. F. Ehrlich, and A. B. Thum.
Journal of the Fisheries Research Board of Canada, Vol. 31, No. 1, p 81-84, 1979. 1 fig, 2 tab, 9 ref.

Descriptors: *Power plants, *Larval growth stage, Juvenile fish, Larval fish, *Methodology, Cooling water, Pumps, Pump testing, Zooplankton, Plankton nets, *Fish sampling, Entrainment.

A high volume pump (2.5 m3/min capacity at 6 m head) and conventional plankton nets (0.5 and 1.0 m diam) 2343 operated side by side in two tests to evaluate the efficiency for each gear for sampling fish larvae within the intake structure of a coastal power plant. At intake channel current velocities up to 40 cm/s (the maximum tested), the pump in one test caught significantly more fish larvae than the nets. Compared to the pump, both sizes of plankton nets in each test greatly undersampled large larvae (over 5.0 mm total length). Our findings suggest that conclusions regarding ichthyoplankton entrainment based on data obtained with conventional plankton nets may be of questionable validity. (Katz-EIS)
W79-04703

LABORATORY STUDIES OF GAS TRACERS FOR REAERATION,
Geological Survey, Bay St. Louis, MS.
R. E. Rathburn, D. W. Stephens, D. J. Shultz, and D. Y Tai.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE2, p 215-229, April 1978. 6 fig, 3 tab, 23 ref.

Descriptors: *Water quality, *Oxygenation, *Aeration, Gases, Absorption, Analytical techniques, Effects, Contaminants, Tracers, Reaeration, Laboratory tests, Least-squares method, Data analysis, Calculation procedures, Systems analysis, Equations.

Laboratory studies have been conducted to determine the rates at which ethylene and propane desorb from a water bath relative to the rate at which oxygen is absorbed by the same water. The ratios between the oxygen absorption coefficient and the hydrocarbon desorption coefficient are 1.15 and 1.39 for ethylene and propane, respectively. These ratios serve as the basis for a tracer technique for measuring reaeration coefficients of streams. Comparison of 2-parameter and 3-parameter procedures shows that the 3-parameter procedure is able to fit the data better in terms of a root-mean-square error. However, estimates of the saturation concentration for dissolved oxygen with the 3-parameter procedure are unrealistic. Therefore, a 2-paramete procedure with the saturation concentration fixed at a literature value for the specific temperature and corrected for barometric pressure has been used. The 2-parameter procedure has also been used for the hydrocarbon data with the equilibrium concentration fixed at zero. (Bell-Graf–Cornell)
W79-04712

TRANSPORT OF NUTRIENTS AND CARBON FROM THE NANAIMO RIVER TO ITS ESTUARY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 2L.
W79-04726

FACTORS CONTROLLING THE ESTUARINE CHEMISTRY OF ARSENIC,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 2L.
W79-04728

COMPARATIVE STUDY OF THE FIXATION OF INORGANIC MERCURY ON THE PRINCIPAL CLAY MINERALS AND THE SEDIMENTS OF THE LOIRE ESTUARY,
Nancy-1 Univ. (France). Lab. de Toxicologie.
For primary bibliographic entry see Field 2L.
W79-04730

PARALYTIC SHELLFISH TOXINS IN THE SEA SCALLOP, PLACOPECTEN MAGELLANICUS, IN THE BAY OF FUNDY,
Rhode Island Univ., Kingston. Coll. of Pharmacy.
C P. Hsu, A. Marchand, and Y. Shimizu.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 1, p 32-36, 1979. 1 fig, 1 tab, 20 ref.

Descriptors: *Toxicity, *Public health, *Commercial shellfish, Zooplankton, Protoza, Dinoflagellates, Chemical analysis, Molluscs, Toxin, Paralytic

shellfish poison, Gonyautoxin, Neosaxitoxin, *Gonyaulax, Ba of Fundy.

The paralytic shellfish poison of the giant sea scallop, Placopecten magellanicus, from the Bay of Fundy has been analyzed. Of eight toxins isolated, seven were identified with those previously recognized in various sources including the Atlantic toxic dinoflagellate, Gonyaulax tamarensis cells. The major components were gonyautoxin-I, gonyautoxin-II, and neosaxitoxin; saxitoxin was responsible for only a very small portion of the total toxicity. A minor toxin that was eluted between neosaxtoxin and saxitoxin in the chromatography system was found to be new and designated as gonyautoxin-VII. (Katz-EIS)
W79-04825

ZINC CONTENT OF THE GILLS OF RAINBOW TROUT (S. GAIRDNERI) AFTER TREATMENT WITH ZINC SOLUTIONS UNDER NORMOXIC AND HYPOXIC CONDITIONS,
Bristol Univ. (England). Research Unit for Comparative Animal Respiration.
For primary bibliographic entry see Field 5C.
W79-04836

THE HYDROLYSIS OF AMMONIUM IONS IN SEA WATER-EXPERIMENTAL CONFIRMATION OF PREDICTED CONSTANTS AT ONE ATMOSPHERE PRESSURE,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
M. Whitfield.
Journal of the Marine Biological Association of the United Kingdom, Vol 58, p 781-787, 1978. 15 ref, 6 tab.

Descriptors: *Chemical reactions, *Ammonium salts, *Toxicity, *Aquiculture, *Hydrolysis, *Nitrogen cycle, Ammonium compounds, Nitrogen compounds, Chemical analysis, Water pollution sources, Water quality, Water quality control, Ions, Sea water, Pollutant identification, Mathematical models, Water temperature.

Recent experimental measurements have confirmed the accuracy of earlier calculations of the extent of hydrolysis of ammonium ions in sea water over a range of temperature and salinity. Tables of the percentage of un-ionized ammonia in sea water compiled from the calculated data can therefore be used with confidence in assessing ammonia toxicity in mariculture systems. (Katz-EIS)
W79-04844

ACUTE TOXICITY OF 12 INDUSTRIAL CHEMICALS TO FRESHWATER AND SALTWATER ORGANISMS,
Rice Univ., Houston, TX. Dept. of Biology; and Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
H. W. Curtis, T. L. Copeland, and C. H. Ward.
Water Research, Vol. 13, p. 137-141, 1979. 6 tab, 9 ref.

Descriptors: *Toxicity, *Industrial wastes, *Bioassay, Chemical wastes, Organic compounds, Minnows, Shrimp, Ammonium compounds, Arsenic compounds, Copper compounds, Chlorides, Sodium compounds, Physiocochemical properties, Aquatic animals, *Palaemonetes, *Pimephales, Penaeus.

Aquatic animal toxicity is a major criterion used by the U.S. EPA to designate and classify hazardous substances other than oil. This research developed basic toxicity data for twelve industrial chemicals with which little or no previous testing had been done. Static 96 h toxicity tests were performed with one freshwater species (fathead minnow) and one saltwater species (grass shrimp or white shrimp) on the following chemicals: ammonium chloride, arsenic trisulfide, benzoyl chloride, benzyl chloride, cupric acetate, o-dichlorobenzene, dichlorobenzene, mercuric acetate, mercuric cyanate, resorcinol, sodium hypochlorite and toluene-2,4-diisocyanate (TDI). As defined by 96 h LC50's plus or minus 500 mgl-1, all 12 chemicals were hazardous to freshwater minnows, and all but TDI were hazardous to saltwater shrimp. The physicochemical behaviors of the compounds greatly influenced their aquatic toxicities. (Deal-EIS)
W79-04845

A NEW AQUARIUM FOR THE STUDY OF TEMPERATURE BEHAVIOUR OF FISH,
Norsk Inst. for Vannforskning, Blindern (Norway).
G. B. Nilsen, and K. H. Roed.
Sarsia, Vol. 63, No. 4, p 199-202, 1978. 7 ref, 4 fig.

Descriptors: *Water temperature, *Methodology, *Fish behavior, *Aquaria, *Equipment, Sticklebacks, Bioassay, Behavior, Aquatic environment, Laboratory tests, Temperature, *Temperature gradient, *Gasterosteus.

The aquarium is based on stable vertical temperature gradients. Different sections, where temperatures can be regulated by the incoming water, are separated by partitions allowing free passage of fish between each section. Seepage of water between the sections is prevented by varying the water levels of the different sections through the outflow system. The temperature distribution in the aquarium is monitored. Testing of the stability of the system was made by adding ink to the water supply of one of the sections. The utility of the system was demonstrated on the three-spined stickleback, Gasterosteus aculeatus. (Katz-EIS)
W79-04846

AMBIENT CONCENTRATIONS OF PCBS IN THE SOUTHEAST FROM STORET DATA AND SELECTED EPA STUDIES,
Environmental Protection Agency, Athens, GA. Surveillance and Analysis Div.
R. J. Bruner, and D. W. Hill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 042, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-904/9-77-032, 1977. 22 p, 3 fig, 8 tab, 6 ref.

Descriptors: *Polychlorinated biphenyls, *Pesticide residues, Aromatic compounds, Chlorinated hydrocarbon pesticides, Sediments, Water chemistry, Water quality, Chemical analysis, Lakes, Food chains, Public health, Fish physiology, Animal metabolism, Bass, Sunfishes, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Kentucky, *Tissue analysis, *Bioaccumulation, *Biomagnification.

The PCB problem in the southeast came to light in 1976 with the discovery of high concentration of PCBs in fish tissues collected from Lakes Weiss and Hartwell. Tissue, sediment and water data from these lakes are reported and analyzed. Big Cypress Swamp data are presented and analyzed to determine background concentrations of PCBs in areas remote from human activities. STORET data for the States of NC, SC, GA, FL, AL, MS, TN and KY were analyzed and potential problem areas are defined. The extent of the PCB problem is evaluated and recommendations are made regarding future sampling needs. (DEAL-EIA)
W79-04848

FLUX OF CERTAIN RADIONUCLIDES IN THE BLOOD-CLAM ANADARA GRANOSA LINNEAUS UNDER ENVIRONMENTAL CONDITIONS,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
B. Patel, S. Patel, M. C. Balani, and S. Pawar.
Journal of Experimental Marine Biology and Ecology, Vol. 35, p 177-195, 1978. 7 fig, 7 tab, 28 ref.

Descriptors: *Clams, *Path of pollutants, *Radioisotopes, *Caesium, *Radioactive wastes, Absorption, Commercial shellfish, Public health, Cobalt radioisotopes, Animal physiology, Metabolism, Invertebrates, Benthic fauna, Mollusks, Sediments, On-site investigation, *Bioaccumulation, *Cerium, *Ruthenium, *Anadara.

The flux of fission product nuclides, caesium-137, cerium-144, and ruthenium-106, in the Bombay Harbor ecosystem was measured over a period of six years during which the input of controlled low level radioactive waste was reduced by more than 20 times. The arcid clam Anadara granosa showed a specific affinity for all three radionuclides with the greatest bioaccumulation of cerium and least of caesium. The concentration of these nuclides varied with levels in the sedimentary material. On reaching maximum accumulation the levels of all three nuclides in the clam population decreased exponentially with time although the radioactivity was still available especially in the sediment. This decrease of radioactivity is defined as an 'ecological loss rate', which was 3-6 times longer than the physical half-life of cerium-144 and ruthenium-106, but was significantly shorter for caesium-137. The bioaccumulation of an activation product nuclide cobalt-60 increased with the time of exposure but was independent of the ambient concentrations and temperature. The species was found to maintain the tissue concentration of fission product nuclides through adjusting physiological flux rates in equilibrium with changing levels in the environmental matrices, but not of the activation product nuclide cobalt-60. (Katz-EIS)
W79-04849

ENVIRONMENTAL QUALITY RESEARCH. USE OF UNICELLULAR ALGAE FOR EVALUATION OF POTENTIAL AQUATIC CONTAMINANTS. SECOND ANNUAL REPORT,
California Univ., Irvine.
J. Scherfig, P. S. Dixon, C. A. Justice, and R. A. Appleman.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A051 327, Price codes: A02 in paper copy, A01 in microfiche. Aerospace Medical Research Laboratory, Report No. AMRL-TR-77-53, Air Force Systems Comman, Wright-Pattersen AFB, Ohio, 25 p, 1977. 6 fig, 17 tab, 6 ref.

Descriptors: *Bioassay, Fuels, *Algae, *Chlorophyta, Organic compounds, Chemical properties, Chemical analysis, Chemical reactions, Toxicity, Chemical wastes, Nutrients, Salinity, Food chains, *Selenastrum, *Dunaliella, Rocket fuels, *Hydrazine.

Selenastrum capricornutum and Dunaliella tertiolecta were used as test algae in bioassays to determine the toxic and/or biostimulating effects of hydrazine and methylated hydrazines in various fresh water and marineaquatic environments. Standard batch algal assay procedures were used to determine safe concentrations and effective concentrations for the compounds studied. Chemical analyses were performed to determine compound stability under the various test conditions. (Deal-EIS)
W79-04850

RAPID, QUANTITATIVE DETERMINATION OF BACTERIA IN WATER,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
E. W. Chappelle, G. L. Picciolo, R. R. Thomas, E. L. Jeffers, and J. Deming.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-22585, Price codes: A03 in paper copy, A01 in microfiche. NASA Case Number GSC-12158-1, 1978. 40 p. 5 fig.

Descriptors: *Analytical techniques, *Bioluminescence, *Aquatic bacteria, Enzymes, Biochemistry, Chmical analysis, Bacteria, Biomass, Laboratory equipment, Filters, Cytological studies, Water quality, *Luciferase, *ATP, *Chemiluminescence.

An invention that speeds the quantitative analysis of bacteria in water is reported. A synthetic polymer hollow fiber filter/concentrator is employed to concentrate bacteria in a water samply by either forcing the water across the filter or by recirculating the water through the filter to remove the filtrate. A system for automating bacteria concentration employng the filter/contractor is provided.

A bioluminescent and a chemiluminescent assay for making a quantitative determination of waterborne bacteria is also provided. The bioluminescent assay employs a luciferase-luciferin mixture reaction while the chemiluminescent assay employs a luminol reaction. (Deal-EIS)
W79-04877

IMPINGEMENT AND ENTRAINMENT OF FISHES AT THE SAVANNAH RIVER PLANT AND NPDES 316B DEMONSTRATION,
DuPont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
For primary bibliographic entry see Field 5B.
W79-04879

THE POTENTIAL IMPACTS ON AQUATIC ECOSYSTEMS FROM THE RELEASE OF TRACE ELEMENTS IN GEOTHERMAL FLUIDS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W79-04881

METHOD FOR DETECTING WATER POLLUTANTS,
Department of the Army, Washington, DC.
M. K. Razulis.
U.S. Patent No. 4,125,376, 5 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 2, p 541, November 14, 1978.

Descriptors: *Patents, *Sampling, *Water pollution, *Water pollution sources, Water analysis, On-site tests.

An improved method for identification and qualitative determination of potentially harmful pollutants in water through the use of a sampling test tube apparatus consists essentially of a test tube containing a foam cube which has been impregnated with a detection chemical solution selected to react colorimetrically with specific pollutants to be detected. The invention provides a simple on-site analytical test procedure for rapid, sensitive and specific identification of water born substances. Also the process can obtain more reproducible differentiation between known chemicals and biological compounds in water without the need for technically trained personnel. (Sinha-OEIS)
W79-04897

TRACE ELEMENTS IN THE SEDIMENTS OF THE BUFFALO RIVER, ARKANSAS,
Arkansas Univ., Fayetteville.
G. H. Wagner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 916, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, 1974. 86 p, 27 fig, 18 tab, 19 ref, 1 append. OWRT A-025-ARK(1).

Descriptors: *Trace elements, *Pollutant identification, *Chemical analysis, Rivers, *Arkansas, Environment, Environmental effects, Sediments, *Buffalo River(AR).

Samples were taken over 130 miles of the Buffalo River in northern Arkansas in order to determine trace elements present in sediments. Aqua regia extracts of the minus 95 mesh fraction of the sediments were analyzed by atomic absorption for sodium, potassium, magnesium, calcium, zinc, cadmium, copper, lead, arsenic, mercury, iron, cobalt, chromium, nickel, and manganese. Zirconium and total iron were determined by x-ray fluorescence. There was a general decrease downstream in iron, copper, chromium, nickel, maganese, lead, potassium, and sodium as the drainage area increased in carbonate rock and decreased in shale. The elements magnesium, clacium, zinc, and cadmium increased in sediments downstream. Cobalt was generally low and constant. The sediments sampled were mainly quartz and chert. These grains are apparently coated with hydrous iron oxide which acts as a sorbent for cobalt, chromium, nickel, copper, manganese, and potassium. Other elements, particularly magnesium, calcium, zinc, cadmium, lead, and zirconium, are mostly carried in the stream in clastic grains. Anomalously high concentrations of these latter elements occurred near old mill sites and known mineral deposits. It was concluded that zinc and cadmium were sufficiently high near old mill sites to warrant concern as pollutants. (Wares-IPA)
W79-04956

STUDIES ON THE UPTAKE OF CADMIUM BY THE CRAB CARCINUS MAENAS IN THE LABORATORY. I. ACCUMULATION FROM SEAWATER AND A FOOD SOURCE,
Queen Mary Coll., London(England). Dept. of Zoology and Comparative Physiology.
J. R. Jennings, and P. S. Rainbow.
Marine Biology, Vol. 50, p 131-139, 1979. 4 tab, 16 ref.

Descriptors: *Cadmium, *Absorption, *Crabs, Brine Shrimp, Animal physiology, Animal metabolism, Heavy metals, Path of pollutants, Radioactivity techniques, Tracers, Chemical analysis, Food chains, Predation, *Tissue analysis, *Bioaccumulation.

The crab Carcinus maenas was exposed to radioactivity labelled cadmium dissolved in seawater at concentrations of 0.1, 1 and 10 ppm, the latter concentration being toxic to the crabs (50% mortality after 12.3 days). Net accumulation of cadmium from solution was proportional to the level and time period of cadmium exposure. The highest tissue concentration was found in the midgut gland, reaching 0.786 mg Cd g-1 dry weight after 12.3 days average exposure to 10 ppm Cd. The midgut gland only contained about 10% of the total cadmium absorbed from solution, while the exoskeleton contained the bulk of absorbed cadmium (59 to 80%) probably passively adsorbed onto the surface. When cadmium was absorbed by the crabs from a food source, the midgut gland contained 16.9% of the total cadmium whereas the exoskeleton now contained only 22.2%. Ten percent of the cadmium available in the food source (Artemia salina) was accumulated by the crabs. When placed in cadmium-free seawater, crabs that had accumulated cadmium from solution lost 69% of the absorbed cadmium in 10 days, mostly from the exoskeleton which lost 78% of its original absorbed cadmium concentration. (See also W79-04969) (Deal-EIS)
W79-04968

STUDIES ON THE UPTAKE OF CADMIUM BY THE CRAB CARCINUS MAENAS IN THE LABORATORY. II. PRELIMINARY INVESTIGATION OF CADMIUM-BINDING PROTEINS,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
J. R. Jennings, P. S. Rainbow, and A. G. Scott.
Marine Biology, Vol. 50, p 141-149, 1979. 7 fig, 1 tab, 21 ref.

Descriptors: Cadmium, *Absorption, *Crabs, *Proteins, Animal physiology, Animal metabolism, Biochemistry, Heavy metals, Path of pollutants, Amino acids, Chemical reactions, Chemical analysis, Water chemistry, Chromatography, *Tissue analysis.

All internally distributed water-soluble cadmium absorbed by the crab, either from solution or from a food source, is associated with protein. Water-soluble extracts of the midgut gland, muscle, gill and remaining internal body tissues (the 'rest') have been separated chromatographically and the absorbed cadmium contents of separate protein fractions measured. In the midgut gland, 'rest' and gill, cadmium is associated with protein of high (> 50,000) and low (< 6,000) molecular weight in proportion to the amount of protein present. In the muscle, cadmium is bound to high but not to low molecular weight proteins. In addition, two proteins with a high affinity for cadmium have been found with molecular weights of approximately 12,000 and 27,000. The larger cadmium-binding protein is found in the midgut gland and 'rest' (probably the haemolymph), the smaller protein in the midgut gland, 'rest' and muscle. A tentative model of the fate of water-soluble cadmium absorbed by the crab is proposed. (See also W79-04968) (Deal-EIS)
W79-04969

OCCURRENCE OF A NEW TYPE OF SHELLFISH POISONING IN THE TOHOKU DISTRICT,
Tohoku Univ., Sendai (Japan). Lab. of Food Hygiene.
T. Yasumoto, Y. Oshima, and M. Yamaguchi.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 11, p. 1249-1255, 1978. 4 fig, 6 tab, 4 ref.

Descriptors: *Commercial shellfish, *Human pathology, *Toxins, Mussels, Toxicity, Poisons, Hazards, *Public health, Foods, Bioassay, Chemical analysis, Pollutant identification, Epidemiology, *Tissue analysis, *Shellfish poisoning, *Scallops.

A series of food poisonings resulting from eating mussels and scallops harvested in the Tohoku District occurred in late June of both 1976 and 1977. A total of 164 persons were officially documented to have suffered severe vomiting and diarrhea. Toxicity studies using mouse assay on the left-over foods and on shellfishes from the areas where the causative specimens were harvested revealed the presence of an unknown fat-soluble toxin in the hepatopancreas of the shellfishes. The dominant symptoms in human cases were diarrhea, nausea, vomiting, and abdominal pain. The onset time of these symptoms ranged from 30 minutes to a few hours after ingestion and the victims recovered after three days without any ill effects. Epidemiological data indicated that as little as 12 MU of toxin was enough to induce a mild form of poisoning in humans. (Deal-EIS)
W79-04970

EFFECT OF COPPER ON VOLUME REGULATION IN THE MARINE FLAGELLATE DUNALIELLA MARINA,
Miljostyrelsen, Charlottenlund (Denmark). Marine Pollution Lab.
For primary bibliographic entry see Field 5C.
W79-04972

UPTAKE FROM WATER AND TISSUE DISTRIBUTION OF NEPTUNIUM-237 IN CRABS, SHRIMP AND MUSSELS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
J.-C. Guary, and S. W. Fowler.
Marine Pollution Bulletin, Vol. 9, p 331-334, 1978. 3 fig, 3 tab, 17 ref.

Descriptors: *Radioisotopes, *Absorption, *Crabs, *Shrimp, *Mussels, Radiochemical analysis, Commercial shellfish, Radioactivity techniques, Tracers, Tracking techniques, Path of pollutants, Pollutant identification, Water chemistry, Chemical analysis, Animal physiology, Animal metabolism, *Transuranic elements, *Bioaccumulation, *Tissue analysis, *Neptunium.

The uptake of 237Np has been followed in the tissues of mussels, shrimp and crabs exposed to the actinide in seawater under controlled conditions. Bioaccumulation was observed in all tissues examined with the highest concentration factors noted in the external shells of the three species. Despite some incorporation of 237Np into internal tissues it is noteworthy that after prolonged exposure 92-98% of the organisms' total 237Np content was associated with the non-edible shells. The general behaviour of this toxic transuranic element in invertebrate tissues appears to be very similar to that of plutonium. (Deal-EIS)
W79-04975

DETERMINATION OF PETROLEUM HYDROCARBONS IN WATER, FISH AND SEDIMENTS FOLLOWING THE EKOFISK BLOWOUT,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.

R. J. Law.
Marine Pollution Bulletin, Vol. 9, p 321-324, 1978. 2 fig, 3 tab, 8 ref.

Descriptors: *Oil pollution, *Oil spills, Aromatic compounds, Oil, Chemical analysis, Path of pollutants, Mussels, Sediments, Marine fish, Water chemistry, Water analysis, *Tissue analysis, *Crude oil, *Aliphatic compounds.

Samples of fish, water and sediment were collected during the Ekofisk 'Bravo' blow-out and analysed for specific aliphatic and aromatic hydrocarbons. Analysis showed the presence of petroleum hydrocarbons from the blow-out in some of the water samples, but fish and sediments, collected up to a week after it began, showed no evidence of a contribution from the blow-out. (Deal-EIS)
W79-04976

5B. Sources Of Pollution

LIMNOLOGICAL ASPECTS OF LAKE MEAD, NEVADA-ARIZONA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2H.
W79-04506

ENVIRONMENTAL ASSESSMENT OF COAL TRANSPORTATION,
PEDCo Environmental, Inc., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W79-04531

NITRATE AND PHOSPHORUS RUNOFF LOSSES FROM SMALL WATERSHEDS IN GREAT LAKES BASIN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5C.
W79-04535

NUTRIENT BUDGET FOR A RESIDENTIAL STORMWATER CATCHMENT IN DURBAN, SOUTH AFRICA,
National Inst. for Water Research, Congella (South Africa). Regional Lab.
D. E. Simpson, and J. Hemens.
Progress in Water Technology, Vol. 10, No. 5/6, p 631-643, 1978. 6 fig, 3 tab, 13 ref.

Descriptors: *Nutrients, *Fallout, *Rainfall, *Runoff, Watersheds(Basins), Atmosphere, Sampling, Chemical analysis, Urban runoff, Nitrogen, Phosphorus, Pollutants, Path of pollutants, Water pollution, Water pollution sources, Data processing, Analytical techniques, *South Africa, *Durban(South Africa).

Continuous measurements of nutrient deposition from atmospheric fallout and precipitation into a 6.8 ha residential catchment containing 20% impermeable surfaces in the city of Durban were made for a period of 1 year. Stormwater runoff from the catchment was recorded automatically and sampled over the same period. All forms of soluble and suspended nitrogen and phosphorus in rainfall and runoff were determined. The influence of the amount and intensity of rainfall on runoff yield was shown, and deposition of nutrients from the atmosphere and export from the catchment throughout the year were illustrated. A mass balance showed that there was a net export of phosphorus, but there was retention or loss of nitrogen. Expected runoff yields of nitrogen and phosphorus with variation in rainfall amount were presented. The rapid change in nutrient concentration during a runoff event was illustrated, and the doubtful reliability of export values based on isolated observations was demonstrated by the results obtained. The significance of stormwater runoff from urban areas in southern Africa as a factor in the eutrophication of impoundments was discussed. (Sims-ISWS)
W79-04565

DETERMINING NUTRIENT LOADING FROM RAINFALL AND RUNOFF IN SMALL RIVERS,
Technische Univ., Hanover (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
H. R. Verworn.
Progress in Water Technology, Vol. 10, No. 5/6, p 607-617, 1978. 6 fig, 4 ref.

Descriptors: *Nutrients, *Water pollution, *Rivers, Rainfall, Runoff, Nitrogen, Ammonia, Nitrates, Phosphorus, Storm runoff, Hydrographs, Pollutants, Path of pollutants, Water pollution sources, Data processing, Analytical techniques.

Based on measurements of concentrations, rainfall, and runoff, the relations between nutrient loading and the parameters affecting it were developed. The total weight of mass was found by using a coaxial relation that connects amount and duration of rainfall, time of year, and the elapsed time since the last storm as parameters for the average concentration of the storm runoff. For determining the time distribution of the nutrient loading within the storm runoff, the Characteristic Pollutiongraph was introduced. The validity of the found relations was shown by comparing computed and measured results. (Sims-ISWS)
W79-04566

URBAN RUNOFF FROM A ROAD SURFACE--A WATER QUALITY STUDY,
Imperial Coll. of Science and Technology, London (England).
W. Pope, N. J. D. Graham, R. J. Young, and R. Perry.
Progress in Water Technology, Vol. 10, No. 5/6, p 533-543, 1978. 9 fig, 3 tab, 8 ref.

Descriptors: *Urban runoff, *Water quality, *Water pollution sources, Storm runoff, Pollutants, On-site investigations, Sampling, Chemical analysis, Analytical techniques, Hydrographs, Dissolved solids, Hydrogen ion concentration, Heavy metals, Oils, Water pollution, Path of pollutants, *England.

Preliminary results of an investigation into the quality of surface water from a motorway catchment were reported. The removal of several contaminants was studied as a first stage in the generation of a model for quantifying the environmental impact of urban runoff. Hydrological conditions were monitored routinely in three adjacent drainage systems. Automatic sampling systems were installed, and the levels of vehicle oils, specific hydrocarbons, trace metals, and solids, in runoff were estimated. Tentative correlations between contaminant concentrations and environmental conditions were proposed. (Sims-ISWS)
W79-04567

ATMOSPHERIC FALLOUT AND STREET CLEANING-EFFECTS ON URBAN STORM WATER AND SNOW,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Water Supply and Sewerage.
P-A. Malmquist.
Progress in Water Technology, Vol 10, No 5/6, p 495-505, 1978. 7 fig, 5 tab, 9 ref.

Descriptors: *Fallout, *Water pollution sources, *Urban runoff, Storm runoff, Snow, Snowmelt, Melt water, Suspended solids, Heavy metals, Lead, Zinc, Chemicals, Atmosphere, Pollutants, Path of pollutants, Water pollution control, Water quality, *Sweden, Street sweeping, Street cleaning.

The quality of storm water and factors governing the quality have been studied at the Urban Geohydrology Research Group at Chalmers University of Technology since 1972. In a study in Goteborg, the atmospheric fallout was found to contribute to the storm water contents of organic matter by 20%, of total phosphorus by 25%, and of total nitrogen by 70%. The heavy metal contributions from fallout ranged from 7% to 40%. Accordingly, the contents of pollutants in urban storm water may be reduced considerably by reduction of the local pollutant sources. Among these sources the corrosion of building materials and motor traffic were found. Urban snow was found to have significantly higher pollutant concentrations than average storm water from the same area. Urban snow, especially from areas with extensive land use, thus may be hazardous to the receiving waters and should be treated as sanitary sewage. The sweeping of streets may improve the quality of storm water. The sweeping of a street in the outskirts of Goteborg removed 57% of the suspended solids and between 31 and 65% of the heavy metals on the street surfaces. (Sims-ISWS)
W79-04568

THE INTERRELATIONSHIPS AMONG CHEMICAL PARAMETERS IN RIVERS--ANALYSING THE EFFECT OF NATURAL AND ANTHROPOGENIC SOURCES,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
J. S. Davis, and J. Zobrist.
Progress in Water Technology, Vol 10, No 5/6, p 65-78, 1978. 3 fig, 7 tab, 8 ref.

Descriptors: *River, *Chemicals, *Pollutants, *Water pollution sources, Analytical techniques, Watersheds(Basins), Water pollution, Sampling, Data processing, Correlation analysis, Regression analysis, Runoff, Water chemistry, *Switzerland, Factor analysis.

Estimates of the relative loading from natural and anthropogenic sources were made for various river systems. The results of three methods, linear correlations, factor analysis, and regression curve analysis based on a mathematical model, were compared. The methods used can be considered generally applicable for studies on flowing waters. Each method provides a different type of information with respect to the relative contributions to loading from (1) sources emitting a constant load (mainly anthropogenic origins), (2) sources yielding mainly a constant concentration (natural or background levels), and (3) runoff or high water flow in general. Some chemical parameters (e.g., geochemical parameters, orthophosphate, suspended solids) showed a characteristic behavior for all rivers studied. Other parameters (e.g., ammonium, total organic carbon) varied considerably between stations, thus reflecting more the characteristics of the particular drainage area and river systems. (Sims-ISWS)
W79-04569

ENHANCEMENT OF WATER-QUALITY MONITORING SYSTEMS BY INCORPORATING WATER-QUALITY MODELLING AND TIME-SERIES ANALYSIS,
Water Pollution Research Lab., Stevenage (England).
A. C. Wakeford, and G. Knowles.
Water Pollution Control, Vol 77, No 4, p 471-477, 1978. 3 fig, 29 ref, 1 append.

Descriptors: *Water quality, *Monitoring, *Mathematical models, *Time-series analysis, Rivers, Pollutants, Model studies, Dissolved oxygen, Biochemical oxygen demand, Ammonia, Nitrogen, Hydrogen ion concentration, Water pollution, Nitrates, Temperature, Water temperature.

Water quality monitoring systems such as the one developed at the Water Research Centre, England (WRC) have made it easier to gather data from rivers, so that it should now be possible to combine modelling with a monitoring system to enhance day-to-day management of river quality as well as long-term planning. Alternatively, the additional data from monitors can be treated by time-series analysis to obtain statistical relationships between, say, polluting loads and river quality, as well as to find information such as period of travel down a river. A river quality model suitable for working in conjunction with a monitoring system has been developed by the WRC. This model is already in use by some authorities for planning purposes, but in these cases the computer program representing the model is not linked in any way with data from monitors, and in fact the conditions used are pro-

jections for future conditions. In contrast, when used with monitors, the model could be placed with other programs in the minicomputer controlling a monitoring system and it would automatically make new predictions of downstream conditions whenever new data arrived from any monitor. (Sims-ISWS)
W79-04571

THE ROLE OF PLANT RESIDUES IN THE FATE OF CADMIUM IN ECOSYSTEMS. A BUFFER AGAINST CONTAMINATION OF WATER SOURCES,
Delaware Univ., Newark. School of Life and Health Sciences.
F. O. C. Ndu, D. M. Grant, and G. F. Somers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 565, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware Research Project Technical Completion Report (1978). 27 p, 6 fig, 4 tab, 7 ref. OWRT A-038-DEL(1). 14-34-0001-8008.

Descriptors: *Cadmium, Litter, *Leaching.

Cadmium was applied in simulated rain to the surface of 1m2 plots of the litter in a mixed, deciduous hardwood woodlot shortly after leaf fall, either as single applications of 250 or 1250 micrograms or as serial applications at 20-day intervals of 25 or 1250 micrograms. The litter was collected periodically, divided into new, old (partially decayed), and humus fractions and analyzed for Cd content. Samples of soil were also analyzed. The ambient Cd content of the litter was so high that only the highest dosage rates produced significant increases in Cd content. The contaminant moved very slowly through the litter over a period of 18 months. During the first five months only the new litter, that on the surface and to which the contaminant had been applied, showed significantly increased Cd content. During the second winter season this became incorporated largely into the partially decomposed fraction as a result of the additional leaf fall. An additional study with even larger amounts of Cd (5 mg/m2) confirmed the high affinity of litter, in situ, for this element. Laboratory studies using 109Cd and a pulse-chase procedure confirmed the slow movement of cadmium through litter, regardless of the fraction. Other studies in the laboratory showed that K+ and Ca++ could compete with Cd++ for the exchange sites of the litter. Extraction of the litter using standard procedures as for feed analysis virtually eliminated the affinity for Cd++.
W79-04584

CONTENTS OF TOTAL MERCURY, ALKYL MERCURY, AND METHYL MERCURY IN SOME COASTAL FISH AND SHELLS,
Yamaguchi Prefectural Research Inst. of Health (Japan).
For primary bibliographic entry see Field 5A.
W79-04589

INACTIVATION OF POLIOVIRUSES AND COXSACKIEVIRUSES IN SURFACE WATER,
New Mexico State Univ., Las Cruces. Dept. of Biology.
R. T. O'Brien, and J. S. Newman.
Applied and Environmental Microbiology, Vol. 33, No. 2, p 334-340, Feb. 1977. 2 fig, 6 tab, 18 ref. OWRT A-052-NMEX(5), 14-34-0001-7066.

Descriptors: *Microorganisms, *Water pollution, Viruses, New Mexico, Surface waters, *Water temperature, *Inactivation, *Rio Grande River, Poliovirus 1 and 3, Coxsackievirus A-13 and B-1, Infectivity, Viral ribonucleic acid.

Inactivation rates of polioviruses 1 and 3 and coxsackieviruses A-13 and B-1 were determined in situ in the Rio Grande in southern New Mexico, using membrane dialysis chambers. Inactivation of the viruses was exponential, and the rates of inactivation were apparently affected principally by the water temperature. Stability of the viruses in river water differed, with poliovirus 1 and coxsackievirus B-1 being most stable. Typically 1-log reductions of infectivity at water temperatures ranging between 23 and 27C required 25 h for poliovirus 1, 19 h for poliovirus 3, and 7 h for coxsackievirus A-13. At water temperatures of 4 to 8C, the log reduction times for poliovirus 1 and coxsackievirus B-1 were 46 and 58 h, respectively. Results obtained with labeled poliovirus 1 and coxsackievirus B-1 and with infectious ribonucleic acid indicated that inactivation was due to damage to viral ribonucleic acid. Virus-inactivation rates were also affectd by heat sterilization of river water, indicating the presence of a heat-labile or volatile inactivating factor. The inactivating factor in Rio Grande water was apparently present at a constant concentration over a 1-year period. (Stockton-NMex)
W79-04591

RADON IN POTABLE WATER SUPPLIES IN MAINE,
Maine Univ. at Orono. Land and Water Resources Inst.
C. T. Hess, E. G. Coombs, R. E. Casparius, S. A. Norton, and W. F. Brutsaert.
Maine Water Utilities Association, p 10-15, November 1978. 2 fig, 11 ref. OWRT A-045-ME(1). 14-34-0001-9021.

Descriptors: *Potable water, *Radon, Maine, Carcinogens, Radioactive isotopes, Water wells.

Ongoing studies are being done on potable water supplies in Maine in order to determine the geological sources of 222Rn in well water, to determine the rate of transfer of 222Rn into air, to determine the radiation dose due to the radioactivity of 222Rn and its daughters, and to calculate the statistical expectation of cancer and other health effects due to the influence of the radiations of 222Rn and its daughters on humans.
W79-04593

WASTE INJECTION INTO A TWO-PHASE FLOW FIELD: SAND-BOX AND HELE-SHAW MODELS STUDY,
Hawaii Univ., Honolulu. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5E.
W79-04599

SOURCES, LEVELS, AND REACTIONS OF BORON IN FLORIDA WATERS,
Florida Univ., Gainesville. Dept. Environmental Engineering Sciences.
For primary bibliographic entry see Field 2K.
W79-04603

SIMULATION OF URBAN NON-POINT SOURCE POLLUTION,
CH2M/Hill, Redding, CA.
R. C. Sutherland, and R. H. McCuen.
Water Resources Bulletin, Vol. 14, No. 2, p 409-428, April 1978. 3 fig, 9 tab, 1 equ, 13 ref. OWRT-A-030-MD(2), 14-34-0001-8022.

Descriptors: *Simulation analysis, *Water quality control, *Computer models, *Urban pollution, *Non-point source pollution, Effects, Management, Estimating, Alternative planning, Rainfall, Accumulation, Street sweeping, Urban streets, Section 208 planning, Pollutants, Systems analysis.

Public Law 92-500 has mandated the need for evaluating the impact of non-point source pollution on receiving water quality, primarily through Section 208 Area-wide Planning. The Management of Urban Non-Point Pollution (MUNP) model was developed to estimate the accumulation of eight non-point pollutants on urban streets and their removal by both rainfall and street sweeping operations. The model can simulate: total solids or sediment-like material; volatile solids, five-day biochemical oxygen demand; chemical oxygen demand; Kjeldahl nitrogen; nitrates; phosphates; and total heavy metals. The simulated results can be used for investigation of non-point pollution management alternatives. The model is capable of reflecting variation in such diverse factors as physical and chemical characteristics of accumulated pollutants; land use, rainfall, street sweeper, and roadway characteristics; and traffic conditions. By using mean estimates of many input variables for large segments of a city, the MUNP model could be used to quickly assess the magnitude of pollutants annually entering receiving waterways due to non-point source pollution alone. If the results indicate that non-point pollution loadings are sizeable and require further analysis, the MUNP model could be used to define the specific non-point source pollution areas within a city. Hypothetical locations and actual rainfall data for Washington, D.C. have been used to demonstrate some capabilities of the MUNP model. (Bell-Cornell)
W79-04609

PHYTOPLANKTON ECOLOGY OF VANCOUVER HARBOR,
Fisheries and Marine Service, Vancouver (British Columbia). Dept. of Fisheries and Ocean.
J. G. Stockner, and D. D. Cliff.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 1, p 1-10, 1979, 7 fig, 2 tab, 38 ref.

Descriptors: *Phytoplankton, *Primary production, Chlorophyll, Nutrients, Zooplankton, Nitrates, Predation, Water pollution effects, Estuaries, *Domestic wastes, *Industrial wastes, Marine algae, Eutrophication, Vancouver Harbor, Fraser River, Burrard Inlet.

Phytoplankton production and distribution were more examined over a 2-yr period in the Burrard Inlet system, which includes a true fiord, a shallow blind inlet, and a turbulent narrows region that is contiguous to the Port of Vancouver. Greatest annual production occurred in Port Moody Arm with a mean of 532 gC.m-2.yr-1 while the lowest values were in Indian Arm and the Narrows region, averaging about 260 gC.m-2.yr-1. Nitrate and zooplankton grazing were the main factors limiting phytoplankton production in Indian Arm, while flushing and poor light conditions influenced phytoplankton growth in the Narrows and outer Burrard Inlet. Most of the discharges of domestic and industrial wastes have been diverted to the Fraser River, and Vancouver Harbor can be considered relatively clean and pollution-free because of strong tidal mixing and seaward flushing. The only sign of eutrophication in the inlet is in Port Moody Arm where sufficient nutrients from sewage discharges and a relatively stable mixed-layer depth create near optimal conditions for phytoplankton growth. Daily production here is among the highest recorded in the literature for Pacific coastal marine waters. (KATZ-EIS)
W79-04617

BEHAVIOR OF MERCURY IN BIO-SYSTEMS II. DEPURATION OF 203HG2+ IN VARIOUS TROPHIC LEVELS,
Georgia Univ., Athens. Dept. of Food Science.
M. K. Hamdy, and N. V. Prabhv.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 3, p 365-373, 1978. 1 fig, 1 tab, 23 ref. OWRT B-069-GA(5), 14-31-0001-3870.

Descriptors: *Mercury, *Animal physiology, Heavy metals, Bacteria, Path of pollutants, Tissue analysis, *Bioaccumulation.

Factors that influenced the biological elimination and retention of radioactively-labeled mercury were investigated. A low water temperature was found to slow rate elimination in bacterial cells. Mosquito larvae eliminated inorganic mercury at a faster rate than the organic form. The opposite was true for the bacterial cells. No difference in rate of elimination was seen in the guppy. (See also W78-01682) (EIS-Deal)
W79-04619

PHOSPHORUS LOADINGS TO LAKES AND SOME OF THEIR RESPONSES. PART 1. A NEW CALCULATION OF PHOSPHORUS

LOADING AND ITS APPLICATION TO 13 NEW YORK LAKES,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
W. R. Schaffner, and R. T. Oglesby.
Limnology and Oceanography, Vol. 23, No. 1, p 120-134, January 1978. 2 fig, 5 tab, 64 ref. OWRT B-038-NY(3).

Descriptors: *Phosphorus, *Lakes, *Water pollution sources, Analytical techniques, Eutrophication, Water pollution effects, Finger Lakes(NY), Algae, Phytoplankton, Urban runoff, Agricultural runoff, Sewage disposal, Stratification.

Phosphorus loading to lakes should be expressed as a composite of several phosphorus forms rather than as total phosphorus, and as input to a geometric lake unit rather than surface area. Specifically, the sum of soluble reactive phosphorus, soluble unreactive phosphorus, and phosphorus potentially desorbable from particulate matter is expressed as the amount added annually to a volume equivalent to the epilimnion in stratified lakes or total lake volume in unstratified lakes. The paper also: (1) discusses procedures for estimating phosphorus contributions from various sources, especially urban and agricultural runoff; (2) presents phosphorus-loss coefficients for agricultural runoff; and (3) applies the phosphorus-loading methodology to 13 New York lakes (primarily in the Finger Lakes district). The main effect of the new method on calculation is to de-emphasize effects of agriculture and emphasize phosphorus input to shallow lakes. Lakes studied are: Conesus, Hemlock, Canadice, Honeoye, Canandaigua, Keuka, Seneca, Cayuga, Owasco, Skaneateles, Otisco, Oneida, and Canadarago. Possible sources of error in the calculations include: (1) no allowance for phosphorus losses during transit from source to lake or direct additions to streams from the terrestrial system, and (2) the assumption that no industries discharge significant phosphorus to the lakes. The calculation method appears valid for all lakes except those with mean hydraulic residence times 0.5 yr. (Lynch-Wisconsin)
W79-04621

PHOSPHORUS LOADINGS TO LAKES AND SOME OF THEIR RESPONSES. PART 2. REGRESSION MODELS OF SUMMER PHYTOPLANKTON STANDING CROPS, WINTER TOTAL P, AND TRANSPARENCY OF NEW YORK LAKES WITH KNOWN PHOSPHORUS LOADINGS,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
R. T. Oglesby, and W. R. Schaffner.
Limnology and Oceanography, Vol. 23, No. 1, p 135-145, January 1978. 5 fig, 2 tab, 37 ref. OWRT B-038-NY(4).

Descriptors: *Phosphorus, *Lakes, *Regression analysis, *Mathematical models, *Phytoplankton, Analytical techniques, Finger Lakes(NY), Eutrophication, Model studies, Algae, Equations, Trophic level, Water management(Applied), Water pollution effects, Water pollution sources.

Using a new method of calculating phosphorus loading to lakes (presented in a companion paper) based on a composite of several phosphorus forms rather than on total phosphorus, and as input to the summer mixed zone rather than surface area, this study examines responses of 16 lakes in central New York State to such loading as an interrelated series of simple regression models. Regressions describing dependence of summer phytoplankton standing crop and winter total phosphorus concentration on loading and of standing crop on total phosphorus are linear. Those characterizing water transparency as a function of standing crop and winter total phosphorus are parabolic. All regressions showed high correlation coefficients. The overall model comprising these regressions supports the hypothesis that lake phosphorus loading is an important factor controlling phytoplankton standing crop. The regressions are useful for trophic state description and in developing lake management strategies. The revised phosphorus loading calculation method incorporates the sum of soluble reactive and unreactive phosphorus, and phosphorus potentially desorbable from particulate matter. The lakes studied represent a wide range of morphology, hydrology, and phosphorus loading. The methodology presented is valid for all lakes with mean hydraulic retention time > 0.5 yr. It is noted that with very high loadings, phoshorus may no longer control phytoplankton production. (Lynch-Wisconsin)
W79-04622

INPUT FOR A STOCHASTIC CONTROL MODEL OF P LOADING,
Banyaszati Kutato Intezet, Budapest (Hungary).
I. Bogardi, and L. Duckstein.
Ecological Modelling, Vol. 4, No. 2-3, p 173-195, 1978. 3 fig, 1 tab, 72 ref. OWRT B-043-ARIZ(28).

Descriptors: Trophic level, *Phosphorus, *Lakes, *Mathematical models, Lake Balaton(Hungary), Planning, *Agricultural runoff, Nutrients, Nonpoint pollution, Model studies.

A stochastic model for estimating phosphorus loading from nonpoint sources of pollution, is illustrated by Lake Balaton, Hungary. Preliminary practical results are given for Lake Balaton's Tetves subwatershed. Uncertainty in phosphorus loading is described in two categories for eutrophication control: (1) phosphorus dissolved in runoff, and (2) phosphorus fixed or sorbed by sediments. The model defines hydrologic events as follows: Rainfall triggers phosphorus transport from a source such as agricultural fertilizers, resulting in runoff volume V and sediment yield Z. Rainfall events are characterized by amount X1, duration X2, and interarrival time T. The amount of dissolved phosphorus transported is estimated by multiplying dissolved phosphorus concentration (C1) by runoff volume, and the amount of sorbed phosphorus by multiplication of the concentration of phosphorus fixed to sediments (C2) by sediment yield per event. Sediment yield is calculated with the Universal Soil Loss Equation, and peak flow and runoff volume with U.S. Soil Conservation Service empirical formulas. Total seasonal loading is calculated as the sum of a random number of random phosphorus-loading events. The model permits estimation of long-run phosphorus accumulation in sediments, important for a eutrophication control model. As considerable phosphorus loading uncertainty is indicated for Lake Balaton, use of a stochastic model seems appropriate. (Lynch-Wisconsin)
W79-04623

THE INFAUNAL BENTHOS OF A NATURAL OIL SEEP IN THE SANTA BARBARA CHANNEL,
California Univ., Livermore. Lawrence Livermore Lab.
R. B. Spies, and P. H. Davis.
Marine Biology, Vol. 50, p 227-237, 1979. 6 fig, 5 tab, 50 ref.

Descriptors: *Oil, *Toxicity, *Benthic fauna, Biological communities, Aquatic populations, Oligochaetes, Oil pollution, Organic compounds, Statistical methods, Adaptation, Methane, Aromatic compounds, Bottom sediments, Chemical analysis, *Diversity, *Diversity indices, *Polychaetes, *Bioaccumulation.

A diverse infaunal benthic community that exists in the fine sand sediments of a shallow natural oil seep near Santa Barbara, California was studied. The study area and sampling methods are described in this introductory paper. Data presented indicate the adequacy of sampling in revealing horizontal patchiness and vertical faunal distributions. The infauna of the seep and of a nearby comparison area, without seepage but of similar depth and sediment type, are compared. The data indicate a consistently larger but fluctuating density of organisms at the seep station. However, Shannon-Weaver diversity, Peilou's evenness, and measures of dominance-diversity with estimates of graphical skewness and kurtosis are all similar for the two stations. The rank correlation of common species at the stations is significant according to Spearman's rho. Species common to both stations account for 85 to 95% of the individuals, further indicating the high degree of similarity between stations. Denser populations of oligochaetes and the maldanid polychaete Praxillella affinis pacifica suggest some advantages for deposit feeders at the seep station. Mats of the bacterium Beggiatoa sp. are associated with localized intense oil seepage. Hypotheses suggesting trophic enrichment and biochemical adaptation at the seep are presented. (Deal-EIS)
W79-04624

EFFECT OF ENRICHMENT WITH DIGESTED NIGHT SOIL ON THE GROWTH OF MARINE PLANKTON (IN JAPANESE),
Yamanashi Univ., Kofu (Japan). Dept. of Environmental Engineering.
O. Nakayama, M. Ohno, and T. Yasui.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 10, p 1099-1103, 1978. 6 fig, 3 tab, 11 ref. (English abstract).

Descriptors: *Aquatic algae, *Sewage, *Phytoplankton, *Primary productivity, *Organic wastes, *Sewage disposal, Fertilization, Domestic wastes, Growth rates, Laboratory tests, On site investigations, Diatoms, Marine algae, Cyanophyta, Aquatic plants, Nitrogen cycle, Chlamydomanas, Chlorophyll, Phosphates, *Nitzschia.

Enhancement of algal growth and accompanied organisms after fertilization with night soil digested by facultatively anaerobic process was estimated through indoor and outdoor experiments. Seawater enriched with various amounts of digested night soil was inoculated with Nitzschia closterium or mixed population of natural phytoplankton. Growth of Nitzschia and natural plankton especially green flagellates was stimulated by adding 5-20 ml/l and 5 ml/l of night soil, respectively. A floating box made of PVC filled with 100 l of natural seawater enriched with 1 liter of digested night soil was placed on the water surface of Uranouchi-Bay, Pacific coast of Kochi prefecture, Japan. Water temperature was about 13C. Population of plankton and soluble trophic elements were surveyed every week for 4 weeks. Planktonic diatoms, which dominated in the original seawater, were overcome by such unicellular green algae as Platymonas and Chlamydomonas. Some filamentous and coccoid blue-greens and ciliates also propagated. Content of chlorophyll a increased from 2.5 to 43 micrograms/l and soluble phosphates decreased from 10 to 0.5 micrograms/l after 4 weeks. (Katz-EIS)
W79-04626

MATHEMATICAL MODELING OF PESTICIDES IN THE ENVIRONMENT,
Environmental Research Lab., Athens, GA.
J. Hill, IV.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 194-197. February, 1978, 24 ref.

Descriptors: *Pesticide toxicity, *Mathematical models, Model studies, Path of pollutants.

This paper recommends that research needs to be directed toward mathematical modeling that allows translation of laboratory measurements of pesticide effects on growth, physiology, and environmental interaction to field conditions. Further, it suggests that models need to be developed that estimate whole system behavior based upon data representing a limited set of component interactions. Hierarchial models with constrained subsystems and homomorphic structures derived from influence analysis may accomplish these goals in the near future. (Skogerboe-Colorado State)
W79-04648

BASIC MATHEMATICAL MODELS OF TOXICANT TRANSPORT THROUGH THE SOIL PROFILE,
Moskovskaya Selskokhozyaistvennaya Akademiya (USSR).

V. V. Rachinskii.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 201-209, February, 1978. 5 ref.

Descriptors: *Pesticide kinetics, Sorption, Dynamics, *Mathematical models, Chromatography, *Path of pollutants.

Basic mathematical models of toxicant transport through the soil profile are discussed. Mathematical expressions are developed for the sorption dynamics problems using the kinetic parameter of time lag and at a variable velocity of the mobile phase. (Skogerboe-Colorado State)
W79-04649

RESPONSE OF EURYTHERMAL AND STENOTHERMAL FISH SPECIES TO CHLORINATED DISCHARGES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
D. S. Cherry, S. R. Larrick, K. L. Dickson, and J. Cairns, Jr.
In: Trace Substances in Environmental Health - XI, p 413-418, 1977. D. D. Hemphill, Ed. University of Missouri, Columbia. 1 fig, 2 tab, 18 ref.

Descriptors: *Chlorine, *Toxicity, *Water temperature, Coho salmon, Rock bass, Bass, Fish behavior, Fish physiology, Chlorination, Control, Biocontrol, Electric powerplants, Fouling, *Hypochlorous acid, *Biocides.

The impact of some steam-electric power production discharges, such as chlorine, upon the response of fish populatins in receiving waters has not been sufficiently investigated to establish scientifically justifiable standards. Two eurythermal fish species, smallmouth bass and rockbass, and stenothermal coho salmon were exposed to serveral 'doubling' conentrations of total residual chlorine (TRC) from 0.025, 0.05. . .0.80 mg/l in a field laboratory located at a power plant. Avoidance responses were tested at acclimation temperatures from 6, 12. . .30C at 6C increments or until the lethal temp was reached. The first significant avoidance to TRC increased with an increase in acclimation temp. The first avoidance increased from 0.05 to 0.20 mg/l TRC for smallmouth bass tested at 6-30C, while coho salmon avoided concentrations from 0.05-0.10 mg/l when tested at 6-18C. Rockbass failed to avoid any chlorinated dose, regardless of the acclimation temp. After the first avoidance, both species showed less avoidance or attraction to higher concentrations of TRC. The avoidance response appeared to be influenced more by the interaction of pH and temp upon the dissociation of hypochlorous acid (HOCl) that comprised the TRC. (DEAL-EIS)
W79-04651

HEXACHLOROCYCLOHEXANE, METAPHOS, AND CHLOROPHOS DECOMPOSITION IN SOIL AND THEIR MIGRATION WITH THE WATERS OF SURFACE RUNOFF,
Hydrochemical Inst., Novocherkassk (USSR).
M. N. Tarasov, L. G. Korotova, A. S. Demchenko, and L. V. Brazhnikova.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 108-116, February, 1978, 3 fig, 2 tab.

Descriptors: Pesticide removal, *Pesticide kinetics, Runoff, *Path of pollutants, Hexachlorocyclohexane, Metaphos, Chlorophos, Pesticide residues, Decomposition.

Great quantities of chemicals and among them pesticides, enter the biosphere due to intensive chemicalization of agriculture. Upon the influence of different factors intensive chemicalization of agriculture. Upon the influence of different factors the greater part of pesticides is decomposed in soil forming primary products and certain preparations are preserved in soil for a long time due to high persistency. Systematic usage of persistent pesticides and those with high cumulative properties at vast watersheds occupied by agricultural lands may result in pollution of natural waters. In order to predict of natural bodies by pesticides, it is necessary to study the rate of their decomposition in different soils, migration capability was well as to obtain quantitative characteristics of their removal from agricultural lands. This paper reports the results obtained from studies of hexachlorocyclohexane (BHC), metaphors, and chlorophors decomposition in soil, thier migration capability as well as the possiblity of washing out by surface runoff. (Skogerboe-Colorado State)
W79-04654

ESTIMATION OF ORGANOCHLORINE PESTICIDE LOSS IN SURFACE RUNOFF WATERS,
Institute of Experimental Meteorology, Obninsk (USSR).
Ts. I. Bobovnikova, E. P. Virchenko, G. K. Morozova, Z. A. Sinitsyna, and Yu. P. Cherkhanov.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 103-107, February, 1978. 1 ref.

Descriptors: Pesticide removal, *Pesticides, Runoff, Water pollution sources, *Path of pollutants, *Organochlorine pesticides, DDT, BHC.

Pesticide migration in water is one of the major pathways of their transport in the environment. Surface runoff water which occurs at the watershed as the result of snowmelt or rainfall causes pesticide removal from the watershed area (agricultural lands and forests) and their entering rivers and basins. Investigations in Russia showed that surface runoff from the watershed was the major source of river water pollution with pesticides. The experimental results obtained show that the loss coefficients of organochlorine pesticides--DDT and gamma-BHC--were low both at the natural waterhseds and at the experimental runoff plots (tenth and hundredth fractions of percent). The gamma-BHC loss coefficient did not exceed 3.7% even when gamma-BHC was applied in the snow cover before the snowmelt, that is under the best runoff conditions. (Skogerboe-Colorado State)
W79-04655

TRANSFORMATION AND TRANSPORT PROCESSES IN AQUATIC SYSTEMS,
Environmental Research Lab., Athens, GA.
G. L. Baughman.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 98-102, February, 1978. 25 ref, 1 equ.

Descriptors: *Pesticide kinetics, Pesticide removal, Aquatic environment, Chemical degradation, Water pollution control, Volatility.

Dynamics of transformation and transport are described in terms of their controlling environmental parameters. Recent advances in ability to mathematically describe the rate and extent of microbiological, chemical, and physical processes are discussed and data are presented to illustrate interrelationships between these processes. (Skogerboe-Colorado State)
W79-04656

COMETABOLISM OF FOREIGN COMPOUNDS,
Akademiya Nauk SSSR, Pushchino. Inst. of Biochemistry and Physiology of Microorganisms.
L. A. Golovleva, and G. K. Skryabin.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 73-85, February, 1978, 6 fig, 11 ref.

Descriptors: *Microbial degradation, *Soil microbiology, Microorganism, Soil microorganism, Herbicides, Chemical degradation, Path of pollutants, Pesticide residues.

The fermentative conversions of many organic substances are closely connected or even depend on oxidation of other compounds--cosubstrates. This dependence is generally called cometabolism. The best known are the cometabolism processes of foreign compound--xenobiotics, though there are also the examples of cometabolism of natural compounds for instance steroids and terpenses as well as such substrates as xylose, widely spread in nature and easily metabolized. The investigations conducted by the authors proved that conversions of many xenobiotics are possible only under cometabolism conditions. the experiments with introduction of microorganisms into natural water reservoirs did not give positive results. However, the degradation of herbicides was significantly accelerated after introducing cosubrates. So, analysis of 2,4-D dynamics in waste waters of rice fields has shown that 2,4-D disappeared more quickly if propionate was used as cosubstrate. In this case the herbicide was not detected in the water in 3 days, at the same time about 25% of initial 2,4-D was present in control experiments (without propionate). (Skogerboe-Colorado State)
W79-04658

PESTICIDE TRANSPORT AND METABOLISM IN MODEL SYSTEMS,
Agricultural Research Service, Beltsville, MD. Pesticide Degradation Lab.
D. D. Kaufman, P. C. Kearney, and R. G. Nash.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, February, p. 61-72. 1978, 6 fig, 2 tab, 14 ref.

Descriptors: Pesticide kinetics, *Pesticide residues, Soil leaching, Assay, Soil microbiology, Microbial degradation, Sorption, Laboratory tests, *Path of pollutants.

Laboratory studies devoted to investigating the environmental fate of pesticides have usually examined individual processes such as microbial metabolism, soil leaching, surface and vapor phase photodecomposition, volatilization from plant or soil surfaces, and plant uptake. In the environment, however, all of these processes may be operative on the molecule, so that in each stage of the pesticide dissipation process, one or more processes may play a major role. It has been extremely difficult to study two or more of these processes under controlled conditions which will enable a clear understanding of the contribution of each. Simplified model laboratory systems are now being developed which enable simultaneously measurement of numerous factors affecting pesticide dissipation in the environment. This paper is a discussion of a few model laboratory systems. (Skogerboe-Colorado State)
W79-04661

HYDROLYTIC AND PHOTOCHEMICAL DEGRADATION OF ORGANOPHOSPHORUS PESTICIDES,
Arkansas Univ., Fayetteville. Dept. of Chemistry.
J. F. Hinton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 705, Price codes: A05 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center University of Arkansas, Report 1978. 72 p, 11 fig, 14 tab, 63 ref. OWRT A-030-ARK(1). 14-34-0001-6004.

Descriptors: *Organophosphorus pesticides, *Pesticides, *Pesticide kinetics, *Degradation, Decomposition, Testing, Equations, Chemical analysis, Water pollution sources, Water pollution, Path of pollutants, Soil contamination.

Research is presented to provide qualitative and quantitative information on the stability of organophosphorus pesticides, their degradation time, their modes of degradation, and the effects of sunlight, temperature, additional chemicals, and environmentally native substances on the rates and path-

ways of decomposition. Ethyl parathion, methyl parathion, and supracide were studied using 31P nmr as the main instrumental technique. Representative chemical shift ranges of the various types of organophosphorus compounds are tabulated. Solvent concentration was greater than pesticide concentrations, so that pseudo-first-order kinetics were assumed and described by a rate equation. An arrhenius plot showing the degradation of the selected pesticides is included. Ethyl parathion degraded slower than the other pesticides at all temperatures studied because methyl esters undergo dealkylation more readily than ethyl esters. Values of 18 to 20 kcal mole-1 were found for phosphorothionate parathion pesticides. (Davison-IPA)
W79-04682

AN AUTOMATED DEVICE (AGARS) FOR STUDYING AVOIDANCE OF POLLUTANT GRADIENTS BY AQUATIC ORGANISMS,
University of West Florida, Pensacola. Faculty of Biology.
For primary bibliographic entry see Field 5A.
W79-04696

QUALITY ASPECTS OF AGRICULTURAL RUNOFF AND DRAINAGE.
American Society of Civil Engineers, New York. Task Committee on Agricultural Runoff and Drainage of the Water Quality.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. IR4, p 475-495, December 1977. 4 tab, 67 ref.

Descriptors: *Agriculture, *Eutrophication, *Drainage, *Runoff, *Sedimentation, *Federal laws, Water management(Applied), Water pollution, Water quality, Plant nutrition, Pesticides.

The ASCE Task Committee on Agricultural Runoff and Drainage has summarized the literature and research findings with respect to sources of pollutants, nature of downstream impacts, and relationships between pollutant loads and certain physical variables. Agricultural discharges from nonirrigated lands are significant contributors of nitrogen, phosphorus, and pesticides to downstream receiving waters. State-of-the-art knowledge indicates that management practices directed toward control of erosion, control of runoff, and management of fertilizer and pesticide application can reduce total pollutant load carried off-site from agricultural lands. The development of on-site discharge water quality control measures, as contemplated under PL 92-500, must be predicated on detailed surveys of a more specific nature due to the high degree of variability in the factors influencing waterborne pollutant transport. (Bell-Graf--Cornell)
W79-04710

A MATHEMATICAL DETERMINISTIC RIVER-QUALITY MODEL. PART I: FORMULATION AND DESCRIPTION,
Water Pollution Research Lab., Stevenage (England).
G. Knowles, and A. C. Wakeford.
Water Research, Vol. 12, No. 12, p 1149-1153, 1978. 1 fig, 5 ref, 2 append.

Descriptors: *Water quality, *Rivers, *Mathematical models, *Forecasting, Model studies, Computer models, Biochemical oxygen demand, Nitrification, Chemical reactions, Denitrification, Photosynthesis, Reaeration, Dissolved oxygen, Equations, Foreign research, River quality model.

A comprehensive river water quality model, deterministic in type, is described in Part 1, and its application to a river catchment is given in Part 2. The 11 processes represented in the model included nitrification, denitrification, photosynthesis, as well as the numerical integration employed. A choice of FORTRAN computer programs is available, each embodying the model--one being for 'interactive' use from a computer terminal, one for conventional 'batch' use at any computer center; while a third form is envisaged for incorporation in a minicomputer or microprocessor controlling remote automatic water quality monitoring stations. This third form would allow predictions of downstream quality immediately data are received from each station, so enabling early warning of impending substandard conditions. An appendix enumerated the processes modelled and the equations used. (See also W79-04722) (Humphreys-ISWS)
W79-04721

A MATHEMATICAL DETERMINISTIC RIVER-QUALITY MODEL. PART 2: USE IN EVALUATING THE WATER-QUALITY MANAGEMENT OF THE BLACKWATER CATCHMENT,
Thames Water Authority, Reading (England).
P. Casapieri, T. M. Fox, P. Owers, and G. D. Thomson.
Water Research, Vol. 12, No. 12, p 1155-1161, 1978. 5 fig, 2 tab, 1 ref.

Descriptors: *Water quality, *Rivers, *Mathematical models, *Management, On-site investigations, Watersheds(Basins), Model studies, Biochemical oxygen demand, Dissolved oxygen, Nitrates, Ammonia, Foreign research, *England, *Blackwater River(England), River quality model.

A deterministic river-quality model was used to predict river qualities in the Blackwater System (part of the River Thames catchment). The model was tested under the relatively dry conditions of 1973 and more normal conditions of 1974. It was concluded that satisfactory agreement between predicted and observed data was obtained. On this basis, the use of the model was extended to simulate conditions for 1981 and 1991 in an attempt to evaluate what the effect on the river quality would be if certain capital works programs were or were not proceeded with. It was demonstrated that with the potential expansion in this catchment area, the quality of the Blackwater would not improve unless capital works programs are carried out. (See also W79-04721) (Humphreys-ISWS)
W79-04722

TRANSPORT OF NUTRIENTS AND CARBON FROM THE NANAIMO RIVER TO ITS ESTUARY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 2L.
W79-04726

FACTORS CONTROLLING THE ESTUARINE CHEMISTRY OF ARSENIC,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 2L.
W79-04728

EFFECT OF SALT UPON HOT-WATER DISPERSION IN WELL-MIXED ESTUARIES,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
For primary bibliographic entry see Field 2L.
W79-04729

THREE-DIMENSIONAL TEMPERATURE MODEL FOR SHALLOW LAKES,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
J. C. Uzzell, Jr., and M. N. Ozisik.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14256, p 1635-1645, December 1978. 6 fig, 10 ref, 3 append.

Descriptors: *Water temperature, *Distribution patterns, *Thermal pollution, *Lakes, *Model studies, Mathematical models, Numerical analysis, Water pollution, Powerplants, Thermal water, Cooling water, Temperature, Temporal distribution, Equations, Dispersion.

A pseudo three-dimensional, time-dependent analytical model was developed for the prediction of temperature distribution in lakes resulting from thermal discharges. For the special case of lakes having a uniform depth, rectangular geometry, and a constant axial velocity, explicit analytical solutions were presented. Sample calculations were performed to demonstrate the effects of the time variation of the thermal loading, different types of boundary conditions, circulation velocities, and eddy conductivity coefficients on the surface temperature distribution along the lake as a function of time. (Sims-ISWS)
W79-04731

TEMPORAL MOMENTS FOR LONGITUDINAL DISPERSION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
Y. H. Tsai, and E. R. Holley.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14266, p 1617-1634, December 1978. 12 fig, 1 tab, 19 ref, 2 append. NSF ENG76-11220.

Descriptors: *Dispersion, *Diffusion, *Channel flow, *Model studies, Mathematical models, Numerical analysis, Open channels, Solutes, Pollutants, Path of pollutants, Water pollution, Distribution patterns, Temporal distribution, Spatial distribution, Tracers, Dye releases, Velocity, Flow, Mixing, Advection.

Aris' moment transformation was used to convert the advective-diffusion equation for two-dimensional (longitudinal and transverse) open channel flow into temporal moment equations. The equation for the zeroth temporal moment of the concentration distribution includes the initial concentration distribution, which is a Dirac delta function for instantaneous injections. This equation can be solved analytically for some specific velocity distributions, but it cannot be solved numerically because of the delta function. Using an implicit finite difference scheme, numerical solutions for both spatial and temporal moments were obtained for plane and centered line source initial conditions and for three velocity distributions. The results were used to examine the relationship between the special and temporal moments during both the initial period and the dispersive period. (Sims-ISWS)
W79-04732

FACTORS AFFECTING THE EXPORT OF NITRATE-NITROGEN FROM DRAINAGE BASINS IN SOUTHERN ONTARIO,
York Univ., Toronto (Ontario). Dept. of Geography.
A. R. Hill.
Water Research, Vol. 12, No. 12, p 1045-1057, 1978. 7 fig, 4 tab, 30 ref.

Descriptors: *Watersheds(Basins), *Water quality, *Water pollution sources, *Runoff, Nitrates, Nitrogen, Agricultural watersheds, Streams, On-site investigations, On-site data collections, Evaluation, Analytical techniques, Discharge(Water), Streamflow, Water pollution.

The export of nitrate-N from 21 watersheds near Toronto, Ontario, was measured over a 25-month period. The annual average loss ranges from 1.41 to 7.31 kg/ha. Analysis of these data indicated a very significant correlation between nitrate exports and percentage of each watershed in crops and abandoned agricultural land. A number of soil and topographic variables also had significant correlations with stream nitrate levels. The causal relationships underlying these simple correlations are difficult to evaluate because of considerable multicollinearity between land use and watershed physiography. The separate analysis of stream discharge indicated that agricultural watersheds have lower mean annual discharges (l/sec/(sq km) than those watersheds containing extensive areas of forest and abandoned agricultural land. Variations in annual discharge, therefore, tended to reduce the contrast in nitrate exports between agricultural and non-agricultural watersheds. The influence of watershed characteristics on nitrate levels exhibited considerable seasonal contrasts. During summer

low flow conditions, nitrate concentration and loss were not correlated with watershed land use; instead they were affected primarily by localized pollution sources and by biological processes within the streams. (Humphreys-ISWS)
W79-04735

ANALYSES OF WATER, CORE MATERIAL, AND ELUTRIATE SAMPLES COLLECTED NEAR YAZOO CITY, MISSISSIPPI, (YAZOO HEADWATER PROJECT),
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 1B.
W79-04793

SELECTED WATER-QUALITY DATA FROM THE MERCED RIVER, CALIFORNIA, NOVEMBER 1976 THROUGH AUGUST 1977,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. J. Hoffman.
Available from OFSS USGS Box 25425, Fed. Ctr. Denver CO 80225. Paper copy $8.25, microfiche $3.50. Geological Survey open-file report 78-735, September 1978. 53 p, 1 fig, 11 tab, 6 ref.

Descriptors: *Water quality, *Water pollution, *Water analysis, *Chemical properties, *Physical properties, Chemical analysis, Surface waters, Federal Water Pollution Control Act, National parks, California, *Merced River, *Yosemite National Park, Lake McClure, Merced Lake, Washburn Lake.

The Merced River originates on the western slope of the Sierra Nevada and flows through Yosemite National Park. The river drains 1,276 square miles before joining the San Joaquin River near Stevinson, Calif. Data were collected from November 1976 through August 1977 to permit a description of the river's quality during a hydrologic cycle. the natural and manmade factors in the basin that affect the quality, and the trends that can be used to reduce degradation in the future. (Woodard-USGS)
W79-04794

A COMPUTER PROGRAM FOR SIMULATING SALINITY LOADS IN STREAMS,
Geological Survey, Cheyenne, WY. Water Resources Div.
K. C. Glover.
Geological Survey open-file report 78-884, November 1978. 31 p, 2 fig, 7 tab, 3 ref.

Descriptors: *Computer programs, *Salinity, *Movement, *Streams, *Analytical techniques, Path of pollutants, Water quality, *Salinity transport, *Chemical loads.

A FORTRAN IV program that simulates salinity loads in streams is described. Daily values of stream-discharge in cubic feet per second, or stream-discharge and specific conductance in micromhos, are used to estimate daily loads in tons by one of five available methods. The loads are then summarized by computing either total and mean monthly loads or various statistics for each calendar day. Results are output in tabular and, if requested, punch card format. Under selection of appropriate methods for estimating and summarizing daily loads is provided through the coding of program control cards. The program is designed to interface directly with data retrieved from the U.S. Geological Survey WATSTORE Daily Values File. (Woodard-USGS)
W79-04800

CHEMICAL ANALYSES OF WATER FROM THE MINNELUSA FORMATION AND EQUIVALENTS IN THE POWDER RIVER BASIN AND ADJACENT AREAS, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
D. K. Wells, J. F. Busby, and K. C. Glover.
Wyoming Water Planning Program Report No 18, January 1979. 27 p, 1 fig, 2 tab, 5 ref.

Descriptors: *Water quality, *Chemical analysis, *Water wells, *Springs, *Drill holes, Oil, Exploration, Water analysis, Water utilization, Well data, Groundwater availability, Wyoming, *Powder River basin, *Minnelusa Formation.

Data are presented for 46 water wells, 5 springs, and 373 oil and gas test holes penetrating rocks of Lower Permian and Upper Pennsylvanian age in the Powder River structural basin and adjacent areas in Wyoming. A table states water-quality criteria with recommended limits and another table lists well locations, depths, and chemical constituents. A map showing locations of sample points also is included. (Woodard-USGS)
W79-04807

ASSESSMENT TECHNIQUES FOR MODELING WATER QUALITY IN A RIVER BASIN AFFECTED BY COAL-RESOURCE DEVELOPMENT,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04808

COMPUTER MODEL OF TWO-DIMENSIONAL SOLUTE TRANSPORT AND DISPERSION IN GROUND WATER,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04813

ENTRAINMENT OF LARVAL FISH BY THE DOUGLAS POINT GENERATING STATION, LAKE HURON, IN RELATION TO SEASONAL SUCCESSION AND DISTRIBUTION,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W79-04816

THE EFFECTS OF SOME POLLUTANTS ON THE SURVIVAL, GROWTH AND RESPIRATION OF LAMINARIA HYPERBOREA,
Liverpool Univ. (England). Dept. of Marine Biology.
For primary bibliographic entry see Field 5C.
W79-04834

TOXIC EFFECTS OF ZINC ON FATHEAD MINNOWS PIMEPHALES PROMELAS IN SOFT WATER,
Environmental Research Lab., Duluth, MN.
For primary bibliographic entry see Field 5C.
W79-04837

TRACE METALS IN THE COMMON MUSSEL, MYTILUS EDULIS (L.), AND IN THE ALGA FUCUS VESICULOSUS (L.) FROM THE REGION OF THE SOUND (ORESUND),
Uppsala Univ. (Sweden). Dept. of Zoology.
D. J. H. Phillips.
Environmental Pollution, Vol. 18, p. 31-43, 1979. 5 fig, 2 tab, 29 ref.

Descriptors: *Mussels, *Aquatic algae, *Heavy metals, Zinc, Cadmium, Lead, Iron, Path of pollutants, Animal metabolism, Animal physiology, Plant physiology, Water chemistry, Chemical analysis, Trace elements, Phytoplankton, *Tissue analysis, *Mytilus, *Fucus, Oresund, Sweden, Norway.

Concentrations of zinc, cadmium, lead and iron were determined in whole soft parts of mussels, Mytilus edulis, and in growing tips of the alga Fucus vesiculosus from a total of 20 locations in the area of the Sound between Sweden and Denmark. Pollution profiles produced for each metal were similar in any one of the species studied but the profiles for metals in M. edulis were distinct from those for metals in F. vesiculosus. Results for mussels agreed broadly with those reported previously for this region, indicating a northward decrease in available metal concentrations. By contrast, results for algae showed few differences in metal availability throughout the study area, although some local effects were evident. The differences in the pollution profiles exhibited by these two organisms depend on their response to different portions of the total trace metal load of ambient waters. Results from the alga agree well with available data on the concentrations of trace metals in solution in waters of the Sound. The alga thus appears to be responding only to metals in solution, as suggested by previous authors. By contrast, the major proportion of the total body load of metals in mussels is derived from ingested phytoplankton. Possible mechanisms for the production of such differences in the metal contents of the two phytoplankton populations, and the ecological implications of these differences, are briefly discussed. (Deal-EIS)
W79-04840

EDIBLE-OIL POLLUTION ON FANNING ISLAND,
Hawaii, Univ., Honolulu. Dept. of Botany.
D. J. Russell, and B. A. Carlson.
Pacific Science, Vol. 32, No. 1, p 1-15, 1978. 7 fig, 6 tab, 31 ref.

Descriptors: *Oil spills, *Oily water, *Fish kill, *Mortality, Reefs, *Pollutants, Organic matter, Water pollution effects, Water pollution sources, Water pollution, Algae, Biological communities, On-site investigation, Cladophora, Crustaceans, Mollusks, Succession, *Edible oil pollution, Vegetable oils, *Fanning Island, *Enteromorpha, *Ulva, Coconut.

In August 1975 the M. V. Lindenbank went aground on Fanning Atoll and dumped 17,797 metric tons of cargo onto a pristine coral reef. Nearly 10,000 tons of the cargo were vegetable oils and edible-oil raw materials such as copra. Although no toxic substances were dumped into the water, the effects of these oily substances were similar to those occurring after a petroleum oil spill. Fishes, crustaceans, and mollusks were killed and an excessive growth of Enteromorpha and Ulva occurred. The animal kill was most likely attributable to asphyxiation and clogging of the digestive tract, while the algal growth was most likely attributable to the elimination of algal competitors, increased fertilization from the pollution and ship, and reduced grazing pressure. Oil may have suppressed certain algal species while stimulating others. Complete recovery of the original coralline algal community proceeded in sequence from Enteromorpha to Ulva to Cladophora-Lyngbya to Hypnea-Caulerpa to Jania-Gelidium. The climax community became evident 11 months after the original spill. (Katz-EIS)
W79-04841

THE EFFECTS OF HEATED EFFLUENTS ON THE PRODUCTION OF MARINE PLANKTON (TAKAHAMA NUCLEAR POWER STATION-I) (IN JAPANESE),
Seikai Regional Fisheries Research Lab., Nagasake (Japan).
M. Anraku, and E. Kozasa.
Bulletin of Plankton Society of Japan, Vol. 25, No. 2, p 93-110, 1978. 11 fig, 5 tab, 14 ref. (English abstract).

Descriptors: *Water temperature, *Zooplankton, *Phytoplankton, *Effluents, *Nuclear powerplants, Marine microorganisms, Aquatic microorganisms, Primary productivity, Water temperature, Heated water, Environmental effects, Thermal pollution, Chlorophyll, Aeration, On-site investigations, Spatial distribution, Heated effluents, ATP.

The effects of heated effluents from Takahama Nuclear Power Station during two five day periods resulted in a reduction of chlorophyll a and ATP in the effluent canal relative to the intake canal. Laboratory experiments with artificial temperature rise and strong aeration produced similar results. The effluent contained a considerable re-

duction in zooplankton as measured by ATP. Laboratory experiments with artificial temperature rise and strong aeration revealed some increase of ATP at 30C and intense decrease at 40C. The reason for this rise has not yet been examined. The results of vital staining confirmed the presence of dead zooplankton, up to 30-40% in the innermost bay in front of the opening of the effluent canal. Reductions in phytoplankton and zooplankton populations seemed to be caused by complex physical and chemical effects resulting from passage through the condenser as well as by the temperature rise. (Katz-EIS)
W79-04842

POLLUTION OF A WATER SUPPLY CATCHMENT BY BREEDING GULLS AND THE POTENTIAL ENVIRONMENTAL HEALTH IMPLICATIONS,
North West Water Authority (England).
F. Jones, P. Smith, and D. C. Watson.
Journal of the Institution of Water Engineers and Scientists, Vol. 32, No. 6, p 469-482, November 1978. 3 fig, 5 tab, 12 ref.

Descriptors: *Water pollution sources, *Watersheds(Basins), *Gulls, *Pollutants, Birds, Water pollution, Water supply, Sampling, On-site investigations, E. coli, Coliforms, Salmonella, Laboratory tests, Data collections, Bacteria, Foreign research, *England.

Routine bacteriological sampling of a distributed potable water supply in 1975 drew attention to the pollution of a water catchment area by the activities of a large colony of breeding gulls. Increased chlorination, additional safety barriers, and improved monitoring resulted in highly improved bacteriological standards of potable water. Investigations were undertaken to enumerate E. coli and to isolate and identify Salmonellae in the raw water. The salmonella serotypes identified correlated well with those isolated from cases of food poisoning reported during the following weeks in the local human population. During the following gull breeding season, a more intensive study was carried out, but the workload limited examination for salmonellae to a qualitative basis. Results confirmed the high levels of microbial pollution on the breeding grounds and in the raw waters. A total of 19 different serotypes of salmonellae were isolated. Little direct correlation was shown with those isolated from local human cases of food poisoning. Evidence indicated that the most probable source of these pathogens was rubbish tips, which were feeding sites lying within the flight paths of the birds. A salmonella cycle involving both human and animal populations was discussed. Proposals were made for the control or possible eradication of this large, well entrenched, not easily accessible colony. (Humphreys-ISWS)
W79-04843

USE OF CHLORINE TO CONTROL OTEC BIOFOULING,
Ecological Analysts, Inc., Melville, NY.
J. A. Fava, and D. L. Thomas.
Ocean Engineering, Vol. 5, p 269-288, 1978. 7 tab, 63 ref.

Descriptors: *Chlorine, *Aquatic microorganisms, *Pest control, *Energy conversion, *Heat exchangers, *Power plants, Condensers, Reviews, Water quality, Feasibility studies, Corrosion, Chlorination, Slime, Pesticides, Antifouling materials, Invertebrates, Pesticide residues, *Ocean Thermal Energy Conversion(OTEC), *Biofouling.

The applicability of chlorine to control Ocean Thermal Energy Conversion (OTEC) biofouling was investigated. Onsite hypochlorite generation was found to be the preferred method of chlorination. The major fouling organisms of concern to OTEC are the microfouling organisms, that is, initial slime layers. However, macrofouling organisms may become a problem after several years of plant operation. Continuous low-level chlorination is more effective against hard-shelled macrofouling organisms and soft-shelled organisms, whereas intermittent chlorination will control slimes and soft-shelled organisms. Actual on-site experimentation is needed before effective doses and chlorination regimes can be recommended. The doses and regimes may vary depending upon whether the condenser and/or evaporator heat exchangers are chlorinated. (Katz-EIS)
W79-04847

AMBIENT CONCENTRATIONS OF PCBS IN THE SOUTHEAST FROM STORET DATA AND SELECTED EPA STUDIES,
Environmental Protection Agency, Athens, GA. Surveillance and Analysis Div.
For primary bibliographic entry see Field 5A.
W79-04848

TEMPERATURE INFLUENCES ON GROWTH OF AQUATIC ORGANISMS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5C.
W79-04851

IMPINGEMENT AND ENTRAINMENT OF FISHES AT THE SAVANNAH RIVER PLANT AND NPDES 316B DEMONSTRATION,
DuPont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
R. W. McFarlane, R. F. Frietsche, and R. D. Miracle.
Report Number DP-1494, 1978. 68 p. 35 fig, 19 tab, 17 ref.

Descriptors: *Entrainment, *Mortality, *Nuclear powerplants, Cooling waters, Intakes, Sunfishes, Channel catfish, Yellow perch, Fish eggs, Larval growth stage, Fish reproduction, Fish populations, Plankton.

Environmental impacts of the Savannah River Plant's withdrawal of Savannah River water include impingement of juvenile and adult fish on trash removal screens, and entrainment of planktonic fish eggs and larval fish into the pumping system. The fish impingement rate at the plant ranks very low in comparison with electric power plants on inland waters. Thirty-five species of fishes were impinged during 1977. The average impingement rate of 7.3 fish per day extrapolates to 2,680 fish per year. No single species comprised more than 10% of the sample. The most commonly impinged species were bluespotted sunfish, warmouth, channel catfish, and yellow perch. The relative abundance of those species impinged deviates from their relative abundance in the canal fish population. Assuming 'worst case conditions,' 6.8 million eggs (9.5%) and 19.6 million larvae (9.1%) were lost due to entrainment. In the absence of reliable fish data regarding the size of the spawning populations and recent population trends, the effect of a maximum 10% loss cannot be estimated. (Deal-EIS)
W79-04879

THE DISTRIBUTION AND ABUNDANCE OF SUBMERGED AQUATIC MACROPHYTES IN A REACTOR COOLING RESERVOIR,
Dupont de Nemours (E. I.) and Co., Aiken, SC. Savannah River Lab.
J. B. Grace.
MS Thesis, Clemson University, Clemson, South Carolina. Report Number DP-MS-77-99, 1977. 152 p, 32 fig, 19 tab, 3 append, 50 ref.

Descriptors: *Nuclear powerplants, *Thermal pollution, *Plant growth, Biomass, Growth rates, Spatial distribution, Heated water, Plant physiology, Plant populations, Chemical analysis, Water pollution effects, Aquatic plants, *Tissue analysis, *Macrophytes, *Myriophyllum, *Eleocharis, *Species diversity.

Measurements of ash-free dry weight were used to characterize the effects of heated effluents on submerged macrophytes in a reactor cooling reservoir. Myriophyllum spicatum comprised more than 50 percent of the total biomass in the areas sampled. The species occurred at depths less than 5m in unheated locations, but not at depths deeper than 3m in heated locations. At depths less than 3m, M. spicatum was most abundant in heated locations 600m-1600m from the point where the heated effluent enters the reservoir. However, the amount of biomass of M. spicatum was greatly reduced in locations less than 400m from the discharge. Examination of the vertical distribution of the shoot biomass of Myriophyllum revealed that plants in heated areas grew closer to the water surface than plants in unheated areas. The biomass of the second most abundant species, Eleocharis acicularis, was less at 0.5m depths in heated areas (more than 5C warmer than unheated areas) than at equal depths in unheated areas. Species diversity was greater at heated locations because of a greater equitability (i.e. evenness of distribution of biomass) among species. (Deal-EIS)
W79-04880

THE POTENTIAL IMPACTS ON AQUATIC ECOSYSTEMS FROM THE RELEASE OF TRACE ELEMENTS IN GEOTHERMAL FLUIDS,
Oak Ridge National Lab., TN.
R. M. Cushman, S. G. Hildebrand, and R. W. Brocksen.
Environmental Sciences Division Publication No. 1097, 1977. 28 p, 4 tab, 32 ref.

Descriptors: *Geothermal studies, *Toxicity, *Trace elements, *Thermal power, Hydrothermal studies, Path of pollutants, Industrial wastes, Chemical wastes, Public Health, Commercial fishing, Electric powerplants, Mortality, Water chemistry, Water quality, Chemical analysis, *Bioaccumulation.

Geothermal energy will likely constitute an increasing percentage of our nation's future energy 'mix', both for electrical and nonelectrical uses. Associated with the exploitation of geothermal resources is the handling and disposal of fluids which contain a wide variety of potentially toxic trace elements. Analyses are presented of 14 trace elements found in hydrothermal fluids from various geothermal reservoirs in the western United States. Potential impacts are conservatively assessed on the basis of (1) toxicity to freshwater biota, and (2) bioaccumulation in food fish to the point where consumption might be hazardous to human health. Trace element concentrations generally range from benign levels which might prove toxic to freshwater biota and contaminate food fisheries. We stress the need for site-specific analyses and careful handling of geothermal fluids in order to minimize potential impacts. (Deal-EIS)
W79-04881

GENERAL LAWS OF THE MIGRATION OF PESTICIDE RESIDUES IN THE DELTA LANDSCAPE UNDER IRRIGATION,
Akademiya Nauk SSSR, Pushchino. Inst. of Agrochemistry and Soil Sciences.
M. S. Sokolov.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 38-46. February, 1978.

Descriptors: Pesticide residues, *Pesticides, Pollutants, Herbicides, Surface runoff, Subsurface runoff, Self-purification, Migration, Water pollution, Sorption, *Runoff.

The process of migration determines diverse aftereffects caused by biocides and other xenobiotics (landscape-regional, regional-basin and global ones) in the biosphere. Migration can be characterized as a complex of processes of redistribution of xenobiotics (and the products of their transformation) in space and in time. In the process of redistribution a pesticide can be transformed into various products. The leftovers of the parent compound together with the products of its transformation are defined as pesticide residues. Xenobiotics are mainly transported in aquatic medium, in atmosphere and through organism migration. In the aquatic medium xenobiotics are transported with the surface and subsurface runoff. In the first case, the compounds are transported in the form of

a liquid runoff (true solutions of electrolytes, compounds with neutral molecules, and colloidal solutions), and in the form of a solid runoff (suspensions, sorbed substances with precolloidal particles or organo-mineral colloids). The subsurface transport of xenobiotics is carried out principally in the form of a liquid runoff. This paper reviews and analyzes investigations conducted on the aspect of migration and transport of pesticide residues through surface and subsurface runoff. (Skogerboe-Colorado State)
W79-04919

PREDICTING AND SIMULATING PESTICIDE TRANSPORT FROM AGRICULTURAL LAND: MATHEMATICAL MODEL DEVELOPMENT AND TESTING,
Environmental Research Lab., Athens, GA.
G. W. Bailey, and H. P. Nicholson.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 30-37, February 1978. 26 ref.

Descriptors: *Pesticide kinetics, Pesticide toxicity, Environmental effects, Computer models, *Mathematical models, Simulation analysis, Small watersheds, Basins.

The transport of pesticides from agricultural lands and other compartments of the environment has generated public apprehension concerning the fate and effects of these compounds. Legislative mandates require guidelines to be developed covering pesticide use in order to prevent or minimize water pollution resulting from pesticide transport from agricultural land. Computer simulation models of the dynamic multiple rainfall-event type are being developed and refined to describe and predict quantitatively transport of pesticides from soil as a function of agricultural management practices, watershed characteristics, climatic factors, and properties of soils and pesticides. This paper discusses the steps involved in development, testing and verification of such models. (Skogerboe-Colorado State)
W79-04920

CERTAIN LAWS OF ORGANOCHLORINE PESTICIDE REDISTRIBUTION IN THE SOIL-WATER, SOIL-PLANT SYSTEM,
Institute of Experimental Meteorology, Obninsk (USSR).
G. G. Zhdamirov, E. E. Popov, and N. F. Lapina.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 714, Price codes: A11 in paper copy, A01 in microfiche.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 47-60. February, 1978. 4 fig, 3 tab, 9 ref.

Descriptors: Pesticides, *Pesticide residues, Evaporation, Sorption, DDT, Environmental effects, Persistence, Barley, Clovers, *Organochlorine pesticides.

One objective was to find the simplest method of estimating organochlorine pesticide evaporation from soils, water, and surfaces. The other objective was to determine the quantitative characteristics of pesticide transport into various species of plants and their distribution in aerial and root parts of plants depending on their content in soil. (Skogerboe-Colorado State)
W79-04921

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX D: CHEMICAL AND PHYSICAL ANALYSES OF WATER AND SEDIMENT IN RELATION TO DISPOSAL OF DREDGED MATERIAL IN ELLIOTT BAY; VOL. II: SEPT.-DEC. 1976,
Washington Univ., Seattle. Lab. of Radiation Ecology.
S. Sugai, W. R. Schell, A. Nevissi, S. Olsen, and D. Huntamer.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-24, June 1978 (in two volumes). 130 p, 19 tab, 1 fig, 1 append, 13 ref.

Descriptors: *Aquatic environment, *Bottom sediments, *Chemical analysis, *Water analysis, *Washington, On-site investigation, *Dredged material disposal, Dredged material, *Waste disposal sites, *Elliott Bay(WASH).

Extent and duration of changes in chemical characteristics of Elliott Bay, Washington, were evaluated six and nine months after disposal of dredged materials from the Duwamish River. The seawater, sediment, and interstitial water were analyzed for the following chemical parameters: Seawater (Suspended solids, arsenic, manganese, mercury, reactive silicate, inorganic phosphate, nitrate, and ammonia); Sediment (Free and total--acid soluble--sulfide, manganese, chromium, arsenic, mercury, and particle size); Interstitial water (Arsenic, manganese, reactive silicate, ammonia, and inorganic phosphate). Temporal, depth, and spatial changes in concentrations of chemical variables were evaluated at disposal and reference sites. Results showed only minimal changes in trace metal concentrations in the water column above the disposal site, but lower Eh and pH values in the sediments than at the reference site. The manganese, inorganic phosphate, and ammonia concentration values were greater in interstitial waters at the disposal site than at the reference site. (See also W79-04928) (WES)
W79-04929

TRACE ELEMENTS IN THE SEDIMENTS OF THE BUFFALO RIVER, ARKANSAS,
Arkansas Univ., Fayetteville.
For primary bibliographic entry see Field 5A.
W79-04956

THE EFFECT OF RECREATION ON WATER QUALITY,
California State Coll., Stanislaus, Turlock. Dept. of Chemistry.
J. E. Byrd, and M. J. Perona.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 012, Price codes: A03 in paper copy, A01 in microfiche.
California Water Resources Center, University of California, Davis. Technical Completion Report, January 1979. 26 p, 13 fig. (California Water Resources Center Project UCAL-WRC-W-531). OWRT A-064-CAL(1).

Descriptors: *Recreation, *Multiple-Purpose reservoirs, *Lead, *Heavy metals, *Pollutant identification, *Chemical analysis, Boating, Water sports, Boat launching ramps.

The purpose was to assess the effect of motorboat usage on the long-term lead concentration of a multipurpose reservoir, Turlock Lake in Stanislaus County, California. As the study was made during two drought years, it was possible to examine the effects of large volume changes in lake. Samples were taken at weekly intervals at the inlet canal where water enters the lake, at the outlet and at the boat dock. An apparent correlation was found between the lead level at the boat dock and the boats per-unit-volume. Also, at the boat dock, the largest lead concentration correlated with the highest boat concentration. The inlet and outlet lead data obtained were treated in terms of a simple plug-flow model. The increase in the lead level of the water as it passes through the lake is greater, by at least a factor of 15, than would be expected on the basis of the number of boats on the lake. The lead concentration was found to correlate with lake volume. Experiments were done to find if an alternate source of lead in the lake is the sediment. The mechanism linking lake volume and lead concentration is unclear but is likely to involve migration of lead from the sediment, which was found to contain exchangeable lead, and/or biotic processes. (Snyder-Calif-Davis)
W79-04963

OCCURRENCE OF A NEW TYPE OF SHELLFISH POISONING IN THE TOHOKU DISTRICT,
Tohoku Univ., Sendai (Japan). Lab. of Food Hygiene.
For primary bibliographic entry see Field 5A.
W79-04970

AMMONIA PRODUCTION RATES OF ARTEMIA SALINA UNDER VARIOUS CULTURE CONDITIONS,
California Univ., Bodega Bay. Bodega Marine Lab.
W. L. Moffett, and W. S. Fisher.
Journal of the Fisheries Research Board of Canada, Vol. 35, p 1643-1648, 1978. 1 fig, 2 tab, 24 ref.

Descriptors: *Brine shrimp, *Ammonia, *Animal wastes(Wildlife), Animal metabolism, Waste identification, Toxicity, Aquiculture, Salinity, Hydrogen ion concentration, Lobsters, Crustaceans, Growth stages, Water chemistry, Water analysis, Enzymes, Digestion, *Platymonas, *Nauplii, *Metabolites.

Artemia salina are used as a live food in the cultivation of several Crustacea and their metabolites add to the metabolites of the cultured species. Because it is toxic, ammonia was monitored over 7-d periods while A. salina nauplii and adults were held in a variety of culture conditions. Ammonia production increased with increasing temperature between 15-25C. Production of ammonia by nauplii was density dependent. No change in ammonia production was shown by adults with alteration of density (200-2000 A. salina/L), salinity (10-50%) or pH (7.0-9.0), or when fed twice daily with 50,000-100,000 cells Platymonas sp./mL. Artemia salina fed ad lib. to cultured experimental lobsters would contribute about 46% of the total ammonia in the culture system. (Deal-EIS)
W79-04971

CADMIUM TURNOVER IN THE SHORE CRAB CARCINUS MAENAS,
Newcastle-upon-Tyne Univ. (England). Dept. of Zoology.
D. A. Wright, and C. C. Brewer.
Marine Biology, Vol. 50, p 151-156, 1979. 5 fig, 1 tab, 8 ref.

Descriptors: *Cadmium, *Crabs, *Absorption, Heavy metals, Path of pollutants, Animal physiology, Animal metabolism, Chemical reactions, Chemical analysis, Biochemistry, Proteins, Radioactivity techniques, Tracers, Salinity, *Tissue analysis.

During cadmium uptake by the shore crab cadmium appears in both haemolymph and urine within 1 h, and comes into equilibrium with the haemolymph after some 60 h. The equilibrium concentration for haemolymph cadmium is always considerably less than that of the external medium, whether the latter is close to background level or at the artificially high concentration of 2.2 mg 1-1. Despite earlier evidence that cadmium entering the haemolymph is mainly bound to protein, current results show most of this to be freely labile and quickly displaced by cadmium taken up subsequently. There is some evidence to suggest that cadmium is passed on from the haemolymph to the hepatopancreas. A large proportion of whole-body cadmium is adsorbed onto the exoskeleton and gills. The comparatively rapid efflux of 109Cd from loaded crabs over a period of 1 week is mainly due to desorption of this cadmium from the outer body surface. (Deal-EIS)
W79-04973

AN EROSION MODEL FOR ARID WILDLAND WATERSHEDS,
Utah State Univ., Logan. Dept. of Soil Science.
For primary bibliographic entry see Field 2J.
W79-04994

CLOSED FORM SOLUTION FOR PESTICIDE LOSS IN RUNOFF WATER,

Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
T. S. Steenhuis, and M. F. Walter.
Paper No. 78-2031, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 27 p, 4 fig, 5 tab, 17 ref, append. ASAE, St. Joseph, Michigan.

Descriptors: Pesticide removal, *Pesticide residues, Runoff, Erosion, Overland flow, Adsorption, Regression analysis.

A closed form solution for pesticide loss in overland flow is presented. All input variables are easily measurable except the depth of the mixing zone. A depth of 0.9 cm for this zone was found by regression analysis using pesticide runoff data reported in literature. For verification, pesticide runoff data from Southern Georgia was used and a reasonable agreement existed between observed and predicted values. (Skogerboe-Colorado State)
W79-05000

5C. Effects Of Pollution

FACTORS AFFECTING ACCURACY OF ICHTHYOPLANKTON SAMPLES USED IN POWER PLANT ENTRAINMENT STUDIES,
Virginia Inst. of Marine Science, Gloucester Point.
R. R. Bowles, J. V. Merriner, and J. Boreman.
Available from Supt. of Documents, GPO, Washington, DC 20402. Report No. FWS/OBS-76/20.7, June 1978. 14 p, 3 fig, 2 tab, 24 ref.

Descriptors: *Sampling, *Ichthyoplankton, *Equipment, *Plankton nets, Pumps, Environmental effect, Powerplants, Entrainment, Investigations, Biology, Aquatic habitats.

Ichthyoplankton sampling gear currently in use, abiotic and biotic factors which may affect attainment of 'representative' samples, and items to be considered in the design and or evaluation of an ichthyoplankton sampling program are reported. In evaluating and comparing the types of sampling gear presently used, it was found that circular meter nets were superior to 0.5 m nets, and that brideless nets were more efficient than 0.5m or 1m nets. Net and pump comparison results were variable. Abiotic factors affecting samples used to assess powerplant impacts include characteristics of the gear, sampling environment, and the powerplant; biotic factors include characteristics of the target organism. A gear selection check list is provided. (Davison-IPA)
W79-04504

LIMNOLOGICAL ASPECTS OF LAKE MEAD, NEVADA-ARIZONA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2H.
W79-04506

EFFECTS OF GEOTHERMAL ENERGY DEVELOPMENT OF FISH AND WILDLIFE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
G. W. Suter, II.
Report No. FWS/OBS-76/20.6, October 1978. 22 p, 2 fig, 2 tab, 31 ref. W-7405-eng-26.

Descriptors: *Geothermal studies, *Fish, *Wildlife, *Environmental effects, Habitat improvement, Air pollution, Water pollution, Water pollution effects, Air pollution effects, Accidents, Hazards, Technology, Research and development.

The nature and technologies for exploration, extraction and use of geothermal resources are reported. The three types now being used, or of potential use are: hydrothermal, geopressured, and hot dry rock. The environmental impacts of the gaseous emissions, particulate emissions, and liquid emissions on fish and wildlife are examined. Potential accidents associated with geothermal development include well blowouts, pipeline ruptures, sump pump failure, holding pond overflow, subsidence, induced seismicity, and loss of thermal springs are discussed. The possibilities of habitat enhancement are explored. (Davison-IPA)
W79-04508

A BIOLOGIST'S MANUAL FOR THE EVALUATION OF IMPACTS OF COAL-FIRED POWER PLANTS ON FISH, WILDLIFE, AND THEIR HABITATS,
Argonne National Lab., IL.
B. G. Lewis, P. C. Chee, R. M. Goldstein, F. C. Kornegay, and D. L. Mabes.
Report No. FWS/OBS-78/75, August 1978. 225 p, 22 fig, 36 tab, 14 ref, 8 append.

Descriptors: *Powerplants, *Environmental effects, *Habitats, *Fish, *Wildlife, *Coal-fired powerplants, Effluents, Solid wastes, Balance of nature, Ecology, Biology.

Information to aid biologists in the review of environmental impact statements and environmental reports is presented. Although many approaches to the assessment of impacts to biota from the operation of a coal-fired powerplant are discussed, the major approach taken here is a 'best judgement' evaluation, made by a biologist familiar with the locality and region. A description of coal-fired powerplants emphasizing components unique to these installations is followed by topical sections corresponding to powerplant features with the potential for adverse effects on fish, wildlife, and their habitats. These sections are: coal slurry pipelines, coal cleaning, coal storage, limestone preparation and storage, air emissions, liquid effluents, solid wastes, and conversion to coal. Each section contains a description of the feature involved, standards and criteria, quantification, information requirements and sources, impact analysis, mitigative measures, additional data sources, and references. (Davison-IPA)
W79-04509

MUNICIPAL WASTEWATER AQUACULTURE,
Robert S. Kerr Environmental Research Lab., Ada, OK. Wastewater Management Branch.
For primary bibliographic entry see Field 5D.
W79-04528

SOURCE ASSESSMENT: RAIL TANK CAR, TANK TRUCK, AND DRUM CLEANING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 5D.
W79-04529

POLLUTION CONTROL GUIDANCE FOR GEOTHERMAL ENERGY DEVELOPMENT,
Industrial Environmental Research Lab., Cincinnati, OH.
R. P. Hartley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 546, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/7-78-101, June 1978. 134 p, 46 fig, 19 tab, 77 ref, 1 append. INE610.

Descriptors: *Pollution abatement, *Geothermal studies, *Environmental effects, *Energy, *Air pollution, *Water pollution control, *Regulation, *Electric powerplants, Solid wastes, Noise, Pollutants, Radionuclides, Radioactive wastes, California, Water pollution sources, Environmental Protection Agency, Water quality standards, Groundwater.

EPA regulations for geothermal energy development are summarized, and geothermal effluents and emissions are categorized: air and water pollutants, solid wastes, radiation, and noise. Discharges from geothermal activities are not viewed as threats to national health and welfare, but may well be locally significant. EPA goals include: (1) use of permits to control discharges prior to establishment of formal regulations, (2) effluent guidelines and revision of water quality standards, (3) regulations for subsurface disposal of spent geothermal fluid, (4) New Sources Performance Standards for gaseous emissions, (5) noise regulation under the Noise Control Act of 1972 or by state and local agencies, and (6) regulation of radioactivity under the water pollution, air pollution, and drinking water regulations. Very few pollution control technologies have been demonstrated for geothermal energy conversion systems. Current development is directed more toward electric power generation from high-temperature, liquid-dominated geothermal systems, and less toward direct heating uses, though the latter are more energy-efficient. The pollution potential of most exploitable geothermal resource probably lies between the extremes of the station at The Geysers, California which produces hydrogen sulfide, and the geothermal resources in California's Imperial Valley characterized by high salinity liquids. (Lynch-Wisconsin)
W79-04530

ENVIRONMENTAL ASSESSMENT OF COAL TRANSPORTATION,
PEDCo Environmental, Inc., Cincinnati, OH.
M. F. Szabo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 936, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/7-78-081, May 1978. 142 p, 35 fig, 31 tab, 52 ref, 2 append. EHE 623. 68-02-1321.

Descriptors: *Water pollution sources, *Coals, *Transportation, *Environmental effects, *Pollution abatement, *Mining, *Pipelines, Water pollution control, Air pollution, Energy, Railroads, Slurries, Barges, Trucks, Conveyance structures, Coal mines, Technology, Effluents, Runoff, Storage, Mine wastes, Research and development, Research priorities, Public health, Toxicity.

Coal mining and preparation methods are discussed, environmental effects of coal transportation by slurry pipeline, railroad, barge, truck, and conveyer are identified, and recommendations are given for control technology research and development. Highest priority research needs: (1) toxic properties of effluents from coal cleaning and storage runoff; (2) pipeline breakage, water availability, reslurrying methods, slurry dewatering, fines treatment, and slurry water and corrosion inhibitor toxic properties; and (3) truck road damage. Transportation of coal in the U.S. is expected to reach 1.32 billion metric tons by 1985. Most effects of coal transportation are not critical in terms of health and welfare and could be reduced by control technology improvements, but coal preparation plant effluents, storage piles, and slurry lines represent toxic hazards, and the toxicity of storage pile runoff and coal slurries is still undefined. Emergency procedures for slurry line breakage must be better defined. Railroads carry most of the coal transported more than 160 km; barges are also used for long-distance transport. Although coal slurry pipelines are capable of long-distance transport, only one is in operation at present. Trucks, conveyer belts, and pneumatic pipelines are functional only over relatively short distances. Energy consumption must be taken into account in planning coal transportation systems. (Lynch-Wisconsin)
W79-04531

INFLUENCE OF TURBIDITY ON FISH ABUNDANCE IN WESTERN LAKE SUPERIOR,
Wisconsin Univ.-Superior. Dept. of Biology.
W. A. Swenson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 502, Price codes: A05 in paper copy, A01 in microfiche. EPA-600/3-78-067, July 1978. 83 p, 16 fig, 21 tab, 40 ref, 1 append. R802455.

Descriptors: *Lake Superior, *Turbidity, *Fish, *Red clay, *Predation, *Water pollution effects, *Soil erosion, *Fish management, *Commercial fishing, Great Lakes, Lakes, Smelts, Herrings, Lake trout, Walleye, Coregonus artedii, Osmerus mordax, Stizostedion vitreum vitreum, Salvelinus namaycush, Zooplankton, Food habits, Light pen-

etration, Animal behavior, Clays, Suspended solids.

One result of turbidity in western Lake Superior caused by erosion of red clay from the shore is that rainbow smelt (Osmerus mordax) respond by moving into the upper 12 m of water where their predation on larval lake herring (Coregonus artedii) increases. Predation by the smelt (introduced artifically into the lake) has contributed to the decline of the formerly abundant western Lake Superior herring population and its commercial fishery. Prior to introduction of the smelt, which became abundant in the 1940s, the turbidity promoted herring production by stimulating high zooplankton densities in near-surface waters where larval herring concentrate. Walleye (Stizostedion vitreum vitreum) tend to concentrate in turbid water where reduced light intensity enhances their feeding success and where presence of smelt increases their food availability. Lake trout (Salvelinus namaycush) showed partial avoidance of turbidity in lake and laboratory tests. Red clay turbidity does not directly influence fish survival, but behavioral changes of fish result in major indirect turbidity effects. High plankton densities and increasing herring growth rates suggest that the herring decline is not a result of food competition with smelt. Rather than attempting to control turbidity, direct fish management is recommended including hatchery rearing of herring to larger size, selective stocking of smelt, and use of walleye predation to control smelt populations. (Lynch-Wisconsin)
W79-04532

BROWNS FERRY BIOTHERMAL RESEARCH SERIES. I. COLONIZATION BY PERIPHYTON, ZOOPLANKTON, AND MACROINVERTEBRATES,
Tennessee Valley Authority, Decatur, AL. Div. of Forestry, Fisheries and Wildlife Development.
B. J. Armitage, T. D. Forsythe, E. B. Rodgers, and W. B. Wrenn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 675, Price codes: A04 in paper copy, A01 in microfiche. EPA-600/3-78-020, February 1978. 9 fig, 9 tab, 13 ref. TV-35013A.

Descriptors: *Invertebrates, *Zooplankton, *Periphyton, *Wheeler Reservoir(AL), *On-site laboratories, *Colonization, *Reservoirs, *Heated water, Algae, Tennessee Valley Authority, Browns Ferry Biothermal Research Station(AL), Fish food organisms, Ecology, Food chains, Tennessee River, Species composition, Species diversity, Habitats, Dominant organisms, Seasonal, Water temperature, Biological communities, Substrates, Research equipment, Mollusks, Insects, Faunal lists, Floral lists.

To study effects of increased water temperature on aquatic organisms at the Browns Ferry Biothermal Research Station on Wheeler Reservoir (Tennessee River), near Athens, Alabama, experimental channels were successfully colonized by Tennessee River organisms over a three-year period (1974-76) under ambient temperature conditions. This report documents colonization by primary and intermediate trophic levels during the first 24 months. Periphyton assemblages were highly productive and diverse, and colonization of bare surfaces was extremely rapid during summer. Abundant zooplankton was composed primarily of shallow-water forms. Macroinvertebrates quickly colonized the channels via inflowing water and air, were as diverse or more diverse than in the reservoir, and were composed of littoral and open-water taxa. Based on species composition, and algal and invertebrate densities, the channels accurately simulated reservoir ecosystems for these trophic levels. Channels drawn down for two months in late fall were successfully recolonized, with increased invertebrate densities. The 12 concrete channels, 114 m long, 4.3 m wide, and two m deep, have substrates of natural reservoir sediments and limestone rock arranged to provide six alternating pools and six rock areas per channel. Water is pumped from the reservoir at 0.66 cu m/min, and channel retention time is about 14 hrs. Dominant invertebrates (numerically) were Oligochaeta, Bivalvia, Amphipoda, Gastropoda, and Chironomidae. (Lynch-Wisconsin).
W79-04533

THE IMPACT OF TURPENTINE RECOVERY ON THE TOXICITY AND BOD OF KRAFT MILL EFFLUENTS,
Pulp and Paper Research Inst. of Canada, Pointe Claire, (Quebec).
A. Wong.
In: Canadian Pulp and Paper Association Technical Section, Spring Conference, May 17-21, 1978, Jasper, Alberta, Preprinted Proceedings, p 88-91. 5 fig, 5 ref, 5 tab.

Descriptors: *Pulp wastes, *Toxicity, *Biochemical oxygen demand, *Turpentine, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Chemical oxygen demand, Water pollution, Foreign countries, Canada, Water pollution control, Waste treatment, Waste water treatment, Kraft mills, Ethanol, Methanol, Acetone.

Studies carried out at the Pulp and Paper Research Institute of Canada suggested that turpentine recovery under normal operating conditions at a kraft mill has little or no detectable effect on the tocicity of the combined mill effluent (CME). On the basis of the mill effluents tested, the concentration of turpentine was 6-100 ml/cu m CME if there was no recovery after condensation of digester relief or blow gases. Turpentine concentrations in excess of the above levels increased the toxicity in several samples of CME. Toxicities calculated from toxicity data of individual component streams of CME generally greater than those measured. For one Canadian kraft mill, BOD and COD increased by 29 and 12%, respectively, at 1.32% turpentine decanter effluent in CME. Without any separation of turpentine in the decanter, the corresponding conentration of pure turpentine in CME was estimated to be about 4.5 ml/cu m CME. However, the increases in BOD and COD are probably not due to turpentine. Water-soluble components such as methanol, ethanol, and acetone, which are normally present in digester blow gases are subsequently in the decanter effluent, should have large effects on the increases in BOD and COD. Thus, improvements in turpentine separation in the decanter, without further treatment of the decanter underflow, might not result in proportional decrease of BOD and COD in CME. (Swichtenberg-ICP).
W79-04534

NITRATE AND PHOSPHORUS RUNOFF LOSSES FROM SMALL WATERSHEDS IN GREAT LAKES BASIN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
B. G. Ellis, A. E. Erickson, and A. R. Wolcott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 574, Price codes: A13 in paper copy, A01 in microfiche. EPA-600/3-78-0128, March 1978. 83 p, 12 fig, 27 tab, 1 ref, 2 append. R-802974-01-0.

Descriptors: *Small watersheds, *Nitrates, *Phosphorus, *Agricultural runoff, *Nutrients, *Crop production, Watersheds(Basins), Great Lakes, Michigan, Fertilizers, Fertilization, Nitrogen, Ammonium, Orthophosphate, Sediments, Storm runoff, Snowmelt, Storms.

Two small watersheds (0.80 and 0.55 ha) on the campus of Michigan State University, East Lansing, were planted in row crops and studied 1974-76 for nitrogen and phosphorus runoff losses. Relatively heavy January-March runoff was due mostly to snowmelt but also to rainfall, with loss of more water than sediment. A single heavy rain 18 April 1975 accounted for most water and sediment losses during the study. Corn cultivation on one watershed and soybeans on the other had no apparent differential effect on runoff. Most nitrogen lost during winter runoff was in the soluble nitrate/ammonium form and could be accounted for by snow nitrogen content. Total nitrogen content of runoff water was 5 ppm N. During summer 82-94% of total nitrogen in runoff was in sediment. Loss of soluble nitrogen during the growing season was only 1-3 kg/ha/yr, less than 1% of applied nitrogen in fertilizers, but excessive organic nitrogen was lost during a major storm (31 and 46 kg N/ha). While ammonium fertilizer applied did not move, it converted quickly to nitrate and nitrate nitrogen moved down into the soil profile. The watersheds were previously heavily fertilized, and absorption sites were saturated with phosphorus. About one-third of total phosphorus lost in water occurred in snowmelt runoff, again mostly accounted for by snow content. During the heavy storm 90% of phosphorus lost was in sediment. Fall nitrogen application is not recommended, and phosphorus should not be added if already high in the soil. (Lynch-Wisconsin)
W79-04535

EFFECTS OF DIVERSION AND ALUM APPLICATION ON TWO EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Geology.
D. G. Cooke, R. T. Heath, R. H. Kennedy, and M. R. McComas.
EPA-600/3-78-033, March 1978. 101 p, 25 fig, 24 tab, 66 ref, 1 append. EPA-R801936.

Descriptors: *Twin lakes(OH), *Aluminum sulfate, *Eutrophication, *Nutrient removal, *Diversion, *Lake restoration, *Water quality control, *Alum, Lakes, Ohio, Alkalinity, Sediments, Algae, Fish, Phytoplankton, Macrophytes, Aquatic weed control, Water pollution control, Nutrient loading, Nutrients, Coliforms, Sewage disposal, Phosphorus, Hypolimnion, Trophic level, Septic tanks, Nonpoint pollution, Point pollution.

Diversion in 1972 of septic tank drainage away from East and West Twin Lakes, two shallow, eutrophic, dimictic lakes in northeastern Ohio, resulted in prompt return to near-zero fecal coliform levels in groundwater, streams, and lakes. However, phosphorus income failed to decrease to an acceptable level by 1976 due to continued inputs of untreated storm flow and nonpoint urban runoff. Lake phosphorus concentrations remained at typically eutrophic levels. Following an initial reduction in algal standing crop in 1973 there was little subsequent change. In July 1975 addition of a maximum hypolimnetic dose of alum (aluminum sulfate) to West Twin Lake effectively retarded phosphorus release from lake sediments for at least one year, with no adverse side effects observed. East Twin Lake served as a control. The maximum aluminum dose, defined as that above which residual dissolved aluminum concentration exceeds the trout-toleration limit of 0.05 mg Al/1, was linearly related to alkalinity and could be determined by simple jar tests. Net internal phosphorus loading was only partially reduced by the alum treatment; the untreated upper zone of the lake (specifically the littoral) was apparently a significant internal source of phosphorus. Alum reduced epilimnetic phosphorus concentration and algal standing crop, but both remained at eutrophic levels; cyanophyte dominance was altered to co-dominance of cyanophytes with dinoflagellates and diatoms. (Lynch-Wisconsin)
W79-04536

FIRST AMERICAN-SOVIET SYMPOSIUM ON THE BIOLOGICAL EFFECTS OF POLLUTION ON MARINE ORGANISMS.
Held 20-24 September 1976, Gulf Breeze, Florida. Environmental Protection Agency Publication No. EPA-600/9-78-007, May 1978. 166 p.

Descriptors: *International cooperation, *Soviet Union, *United States, *Methodology, *Pollutants, *Oceans, *Primary productivity, *Water pollution effects, Phytoplankton, Bacterioplankton, Algae, Heavy metals, Pesticides, Radioactivity, Oil pollution, Testing procedures, Analytical techniques, Model studies, Simulation analysis, Mathematical models, Ecosystems, Bioindicators, Marine biology, Microorganisms, Measurement, Toxicity, Poisons, Bioassay, Aquatic animals

The first Soviet-American symposium on hydrobiological methods for analyzing marine pollution, held 20-24 September 1976 at Gulf Breeze, Florida, followed a series of joint Soviet-American studies of the project 'Influence of Pollutants on Marine Organisms' provided for in the 1972 US-USSR Agreement on Cooperation in the Field of Environmental Protection. The 15 papers deal with modelling of the impact of marine pollution; methods of measuring phytoplankton production in the open sea; abundance of sympatric species and the exponentially broken rod model; effects of radioactivity, pesticides, and heavy metals; estimation of bacterioplankton biomass and growth; standardization of methods for measuring microbiological production and ecosystem research; bioindicators of pollution; persistence limits of ecosystems; and a proposed program for monitoring petroleum-oxidizing microorganisms as oil pollution indicators. Appendices include an abstract of a paper on microcosms as pollution indicators, a report on a Soviet-American research voyage to compare methods of measuring phytoplankton productivity, and a synopsis of several symposium discussions. Future joint projects proposed were: (1) model development and validation, (2) development of a new method for determining primary productivity and influences on it by pollutants, (3) microbiology, and (4) effects of transuranic radionuclides. (See W79-04538 thru W79-04553). (Lynch-Wisconsin)
W79-04537

DESIGN OF SIMULATION MODELS TO DETERMINE BIOLOGICAL IMPACT OF POLLUTANTS ON THE MARINE ENVIRONMENT,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
S. C. Snedaker.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 1-9. 5 fig, 5 ref.

Descriptors: *Pollutants, *Water pollution effects, *Simulation analysis, *Mathematical models, *Marine biology, *Ecosystems, Model studies, Environmental effects, Energy budget, Energy, Biological communities, Biodemographic models, Bioenergetic models, Biogeochemical models, Forecasting, Oceans, Analytical techniques, Methodology.

Simulation models for determining pollutant impacts on marine biota, if they are conservative and reflect real-world, case/effect processes, fall into one of three categories posited by Quinlan: (1) biodemographic, (2) bioenergetic, or (3) biogeochemical. Pollution, though often difficult to define precisely, can be modelled relatively easily if a pollutant is regarded as inducing a stress which alters the potential energy-allocation process of a system--more energy goes into stress-compensating processes and less into competition. The affected system may exhibit many different types of compensatory responses depending on pollutant type and quantity. As pollution may significantly alter the system's basic network pattern, highly aggregated models insensitive to internal network changes may be most appropriate. A common inadequacy of biological models is to focus on component species and population assemblages rather than on the larger system. Odum's modelling methodology (1971) is particularly useful for simulating biological pollution impact because it permits rigorous models to be constructed easily, which include any observable or measureable process. Simulation exercises are viewed as a tool for understanding system processes rather than as the end result of research. (See also W79-04537) (Lynch-Wisconsin)
W79-04538

PROBLEMS OF MODELING THE EFFECT OF POLLUTION ON BIOLOGICAL SYSTEMS OF THE OCEAN,
Akademiya Nauk SSSR, Moscow. Inst. Okeanologii.
M. Y. Vinogradov.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 10-21. 5 fig, 9 ref.

Descriptors: *Oceans, *Mathematical models, *Deterministic models, *Stochastic processes, *Ecosystems, *Marine biology, Model studies, Pelagic zone, Phytoplankton, Zooplankton, Fish, Cephalopods, Sea of Japan, Japan, Pollutants, Water pollution control, Methodology, Analytical techniques, Forecasting, Soviet Union, Algae.

Soviet modelling of effects of pollution on marine ecosystems has concentrated on two approachs: (1) deterministic models of pelagic ecosystems, and (2) special models in which pollution is considered a stochastic process. The homogeneity of pelagic ecosystems facilitates quantitative evaluation of pollution effects. Model structure must dynamically represent both temporal succession of pelagic associations, which affects response to contaminants, and the spatial movement of the water including its ascent into the euphotic layer to its subsequent descent. Pollution is most harmful in the zones of system formation: upwellings and divergences of flow in the tropics, and spring plankton development in temperature zones. The ecosystem can be represented as a set of near-autonomous elements connected by communication channels; signals comprise portions of matter (energy) or information. Two transmittal methods can be distinguished (illustrated by the Sea of Japan): (1) flow, related to a transformation of matter or energy, and (2) transfer, related only to active or passive displacements of water components. The entire system can be divided into cells such that within each cell elements communicate only by flow, while between cells transmission of matter and energy is accompanied by transfer. The basis of stochastic models is that incidence of a pollutant into the ecosystem occurs randomly in time and quantity. (See also W79-04537). (Lynch-Wisconsin)
W79-04539

AMERICAN METHODS FOR MEASURING PHYTOPLANKTON PRODUCTION IN THE OPEN OCEAN,
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
E. J. Carpenter, and W. E. Esaias.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 22-36. 4 fig, 33 ref. NSF DES76-01405.

Descriptors: *Oceans, *Pelagic, *Methodology, *Measurement, *Phytoplankton, *Primary productivity, Testing procedures, Particulates, Analytical techniques, Absorption, Carbon radioisotopes, Scintillation fluors, Darkness, Filtration, Chlorophyll, Light intensity, Light penetration, Salinity, Silica, Incubation, Algae.

Biases in the carbon-14 light-dark bottle method for measuring open ocean phytoplankton productivity may cause two- or three-fold underestimates. Problems include poor carbon-14 isotope quality, high dark-bottle counts, scintillation fluors, and loss of carbon-14 when drying filters. Methods to compensate are designed for pelagic water with low concentration of particulate matter, high light penetration, and relatively constant concentration of dissolved inorganic carbon; with modifications, they can be adapted to low-salinity water of high detrital content. General recommendations: (1) samples should be collected from at least five depths approximating 100% (surface), 50%, 25%, 10%, and 1-3% irradiance, and strong chlorophyll maxima should be sampled; (2) a nontoxic, nonmetal, preferably opaque sampler must be used; (3) artifically illuminated incubation boxes with daylight fluorescent bulbs expose samples to constant, saturating irradiance, and compensate for overcast days; (4) exposures in either ambient or artificial light incubators must not exceed three hours; (5) carbon-14 bicarbonate stocks should be purchased as a crystalline solid and ampulated by the investigator, because commercial ampulated stocks often contain toxic material and high silica concentrations; and (6) the scintillation counter method allows relatively easy standardization of stocks and efficient counting of samples, while use of the thin-window gas-flow beta results in many difficulties. Other aspects are discussed. (See also W79-04537). (Lynch-Wisconsin)
W79-04540

RELATIVE ABUNDANCE OF SYMPATRIC SPECIES AND MODEL OF EXPONENTIALLY BROKEN ROD (EBR),
Moscow State Univ. (USSR). Dept. of Hydrobiology.
V. D. Fedorov.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 37-42. 1 fig, 4 tab, 24 ref.

Descriptors: *Exponentially broken rod model, *Broken rod model, *Abundance, *Phytoplankton, *Biological communities, *Ecology, *Mathematical models, Model studies, Sympatric species, Plant populations, Forecasting, Algae, Distribution, Niches, Biotopes, Species composition, Equations, Competition, Ranking.

The 'Broken Rod' model proposed by McArthur in 1957 for the possible distribution of N individuals among w species (applied to tropical birds) is modified here as the 'exponentially broken rod model' (EBR) to improve predictive capabilities. McArthur's model suffered from restrictive assumptions (that sympatric equilibrium species of approximately the same size and with constant total density are confined to a relatively homogenous biotope), which often results in poor agreement between predictions and observed ecological data. ERB model predictions correlate better with observed data, at least for phytoplankton. McArthur's model assumes that in a homogeneous biotope groups of closely related species retain a stable population ratio, and since relative abundance is constant, it can be predicted by a model. The assumption that in a system in equilibrium niches of sympatric species are contiguous without much overlap presupposes the absence of interspecific competition. Formally, the case is analogous to a segment of a rod of unit length (the biotope) partitioned into w parts by w-1 points falling on it; length of parts is proportional to population sizes of individual species. The EBR model assumes a rod of unit length broken into w parts, and that the w-1 breaking points are independent random variables identically distributed on the interval 0, 1, with density expressed by an equation. A ranking is obtained by ordering the parts after the rod is broken in a decreasing (random) sequence. (See also W79-04537). (Lynch-Wisconsin)
W79-04541

IMPACT OF RADIOACTIVITY ON THE MARINE ENVIRONMENT,
National Marine Fisheries Service, Beaufort, NC.
F. A. Cross.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 63-72. 2 fig, 1 tab, 27 ref.

Descriptors: *Oceans, *Radioactive wastes, *Water pollution effects, *Radioisotopes, *Nuclear wastes, *Radioactivity effects, *Radioecology, Radioactivity, Population dynamics, Phytoplankton, Algae, Marine algae, Fallout, Air pollution effects, Ecology, Ecosystems, Laboratory tests, Water pollution sources, Plutonium, Nuclear powerplants, Poisons, Toxicity, Background radiation.

Introduction of radionuclides into oceans by man has not caused significant adverse effects on marine populations or ecosystems, as assessed by three evaluation methods using published data. Methods: (1) comparison of natural background dose rates to aquatic organisms with dose rates received from artificial radionuclides; (2) compari-

son of artificial radionuclide dose rates with results of laboratory irradiation experiments on marine species; and (3) field studies. Measurable changes in marine populations or ecosystems have not been observed in regions receiving artificial radionuclies; moreover, most estimates of dose rates from such inputs are comparable to natural background dose rates, and are significantly below dose rates generally shown to cause measureable damage to organisms in the laboratory. Though discussions in the literature have focused on somatic effects, no evidence of adverse genetic effects has surfaced. If atmospheric nuclear weapons testing is not resumed on a large scale, the last major ocean contamination will have occurred in the early 1960s, and fallout radioactivity levels have decreased since that time. No widespread contamination has been caused by nuclear power plants or nuclear-powered ships. Major future hazards are catastrophic accidents and plutonium, the most toxic radionculide known. (See also W79-04537). (Lynch-Wisconsin)
W79-04542

THE EFFECT OF RADIOACTIVE POLLUTION OF RESERVOIRS ON FISH,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
I. A. Shekhanova.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 73-76.

Descriptors: *Fish, *Reservoirs, *Water pollution effects, *Radioactivity effects, *Bioaccumulation, *Reproduction, *Fertility, Radioactive wastes, Coasts, Oceans, Ocean dumping, Water pollution sources, Radioactive waste disposal, Chronicity effects, Cesium, Strontium, Rivers, Lakes, Bottom fish, Sediments.

Due to open dumping of low-activity radioactive wastes in coastal regions of seas, bays and inland reservoirs, contamination artificial radionuclides is increasing. Strontium-90 concentration is 0.1-0.2 pCe/1 in oceans, 0.5-1.5 pCe/1 in inland and marginal seas, 1.5-5.0 pCe/1 in rivers, 3.5-12.0 pCe/1 in lakes, and in a number of reservoirs cumulative beta-activity fluctuates 25-2000 pCe/1. Long term biological effects on fish in such waters depends on the absorbed dose and on the cumulative radioactive dose. Internal radiation sources are radionuclides in organs and tissues, and external sources are water, aquatic plants, and bottom deposits. Dose power of radiation from artificial radionuclides is 2-3 orders smaller than radiation from natural sources in marine fish and about equal in river fish, while in lakes (especially in the presence of Cesium-137) the radiation of bottom fish from artificial sources is 5-10 times higher than from natural sources. In reservoirs contaminated by low-activity wastes dose power of radiation of fish from artificial radionuclides ranges 0.1-1-0 rad/day or higher. At all stages of ontogenesis chronic irradiation of sexual organs of fish with a dose power of 0.1-0.3 rad/day disrupts reproduction, and an increase to 1-3 rad/day causes more profound changes. Irradiated fish show reduced parasite and disease resistance. (See also W79-04537). (Lynch-Wisconsin)
W79-04543

A NON-STANDARD APPROACH TO HETEROTROPHY: ATP ESTIMATION OF NATURAL POPULATIONS OF SELECTIVELY-FILTERED BACTERIOPLANKTON AND THEIR GROWTH RATES ON IN-SITU WATER IN DIFFUSION-CULTURE,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
J. M. Sieburth, and D. M. Lavoie.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 77-86. 3 fig, 2 tab, 16 ref. DES 74-01537.

Descriptors: *Bacterioplankton, *Adenosine triphosphate, *Dialysis, *Methodology, *Testing procedures, *Growth rates, *Biomass, Estimating, Research equipment, Diffusion, Cultures, Bacteria, Assay, Filtration, Substrates, Heterotrophy, Phytoplankton, Carbohydrates, Productivity, Plankton, Azores, Nutrients, Chlorophyll, Dissolved oxygen, Atlantic Ocean, Oceans.

A procedure for biochemical estimation of bacterioplankton biomass with adenosine triphosphate (ATP) assay, and a dirct method of estimating bacterioplankton growth rates and growth patterns in-situ with diffusion cultures are described; these methods are alternatives to direct microscopic counting for biomass and the indirect carbon-14 method for growth rate measurement. This paper reports experiments at a station east of the Azores in August 1975, part of a study conducted on a North Atlantic cruise. Bacterioplankton were isolated with Nuclepore membrane filters. ATP was extracted by immersion in boiling Tris (hydroxymethylaminomethane) buffer (pH 9.0 at 20 C) for two minutes and frozen until assayed aboard ship, using a luminescence biometer to measure luciferin-luciferase light reaction. A dialysis culture chamber was constructed using a 0.1-micrometer pore size Nuclepore membrane to retain the bacteria but allow diffusion of natural dissolved substrates and metabolic by-products. Vigorous agitation promoted solute transfer. Bacterioplankton biomass varied from 1.6-8.4 mg C/cu m over the uppermost 250 m, and its distribution strongly correlated with that of phytoplankton and dissolved carbohydrates. Bacterioplankton exposed to water pumped from 50 m (oxygen maximum) and 80 m (chlorophyll maximum) exhibited diurnal growth patterns from which daily production was estimated to be 20-67 mg C/cu m. The calculated mean annual production of 13 g C/cu m was about three times that obtained by other methods. (See also W79-04537). (Lynch-Wisconsin)
W79-04544

THE DEVELOPMENT OF STANDARD METHODS OF MEASURING MICROBIOLOGICAL PRODUCTION,
Moscow State Univ. (USSR). Dept. of Biology.
M. V. Gusev.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978. p 87-94.

Descriptors: *Microorganisms, *Bacteria, *Methodology, *Testing procedures, *Soviet Union, *Research priorities, *Productivity, Analytical techniques, Microbiology, Heterotrophy, Ecosystems, Ecology, Carbon radioisotopes, Photosynthesis, Chemical analysis, Staining, Chemostats, Limiting factors.

Three Soviet methods for determining microbial production are reviewed: (1) determining the increase in the number of bacteria in isolated water samples (Gak, 1975); (2) determination of microbe production by the radiocarbon method according to the rate of assimilation of carbon dioxide (Romanenko and Kuznetsov, 1974); and (3) determining potential microbial production to identify localization of active microbial populations and the effectiveness of bacterial biosynthesis in reservoirs. Research priorities for ecosystem characterization: (1) water chemical analysis, physico-chemical analysis, and makeup and number of microorganisms; (2) quantifying total microorganisms with filter staining, and number of living cells with luminescent microscopy; and (3) prediction of microorganism group abundance based on water composition and other factors using cultures on dense elective media. Priorities for determining true microbe production: (1) total production determination in isolated water samples with the Romanenko-Duznetsova-Sorokin method using carbon-14 with the rate of heterotrophic, chemosynthetic, and photosynthetic CO2-fixation; (2) determine water potential for microorganism production with chemostats; and (3) determine potential microorganism activity with limiting factors. (See also W79-04537). (Lynch-Wisconsin).
W79-04545

USE OF BIOLOGICAL INDICATORS FOR MONITORING EFFECT OF POLLUTANTS ON THE MARINE ENVIRONMENT,
Florida State Univ., Tallahassee. Dept. of Oceanography.
R. L. Iverson.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 95-106. 61 ref.

Descriptors: *Bioindicators, *Bioassay, *Statistical methods, *Methodology, *Testing procedures, *Water pollution effects, *Oceans, Pollutants, Estuaries, Monitoring, Worms, Capitella, Fish, Mollusks, Algae, Phytoplankton, Zooplankton, Analytical techniques, Species composition, Sublethal effects, Chronicity effects, Toxicity, Poisons, Lethal limit.

Biological assay, indicator species, and biostatistical measures are discussed as means of assessing effects of pollutant on the marine environment. Boassay methodology has been developed for single species, and is under development for laboratory exerimental ecosystem bioassays. The bioassay approach is the primary means of predicting effects before pollutants are introduced into the marine environment, and will be important in monitoring sublethal effects on marine organisms. Indicator species (opportunistic species which colonize distrubed environments) are used to monitor after-the-fact pollution effects. The classical saprobic indicator system, based on zonal distribution of indicator organisms, is no longer used tin the U.S.; but some groups of organisms, such as capitellid worms, remain useful indiators of chronic pollution. Quantitative ecological techniques developed for characterizing assemblages of organisms show promise for monitoring pollutant effects. Although no single measure appears to be a conistent indicator of pollutant distrubance of natural aseembladges, a combination of dominance changes, species diversity, and evenness can be used with ordination methods to quanity changes in assemblages caused by pollutant stress or reduction of pollutant stress. Specific organisms used in bioassay and indicator species tests and problems of bioassay interpretation are discussed. (See also W79-04537). (Lynch-Wisconsin)
W79-04546

MICROORGANISMS AS BIOLOGICAL INDICATORS OF COMMERCIAL-DOMESTIC AND PETROLEUM POLLUTION,
Murmanskii Morskoi Biologicheskii Inst. (USSR).
I. B. Tokin, O. N. Trunova, and T. I. Izgoreva.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 107-111. 4 tab, 3 ref.

Descriptors: *Bioindicators, *Microorganisms, *Water pollution effects, *Barents Sea, *Bacteria, *Bacteriophage, Domestic wastes, Municipal wastes, Oil pollution, Salmonella, Shigella, E. coli, Coliforms, Seas, Oxidation, Enterococci, Volumetric analysis, Water pollution sources, Pollutants, Self-purification, Viruses, Tidal effects, USSR.

The degree of pollution of two bays of the Barents SEa, U.S.S.R., by commercial-domestic and petroleum pollutants was measured by concentrations of microbioloical indicators: coliform bacteria, enterococci, petroleum-oxidizing microorganisms, and bacteriophages. Eighty samples representing varying degrees of pollution were taken from the most polluted bay, and 45 samples from a less-polluted bay. Results showed that the more polluted the water, the lower the solution level of sanitary-indicative microorganisms; a change in the solution level of commercial-domestic pollutant indicators correlated with the solution level of the petroleum-destroying microorganisms. In the first bay tests were carried out to relate the percentage of intestinal phages to the degree of pollution of the water by commercial-domestic organic material. The following cultures were used for phage ntrients: Escherichia coli, Shigella sonnei, Sh. Flexneri, Sal-

nonella newland, and S. breslau. Without inoculation, which indicates the high concentration of phage-sensitive bacteria, only phages to E. coli, Sh. flexneri, and Sh. sonnei were isolated from polluted water samples with a solution level of .01. With inoculation, phages were isolated from all three categories of water samples, and the greatest percentage of phage isolation were those to E. coli and Sh. flexneri. Most phages were strictly species specific. In most phages colonies were circular. The tidal hydrological regime significnatly influenced self-purification. (See also W79-04537). (Lynch-Wisconsin)
W79-04547

PERSISTENCE LIMITS IN ECOLOGICAL SYSTEMS,
Environmental Research Lab., Narragansett, RI.
K. T. Perez.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 112-117. 23 ref.

Descriptors: *Ecosystems, *Persistence, *Water pollution effects, *Pollution abatement, *Analytical techniques, *Methodology, Model studies, Computer models, Simulation analysis, Experimental ecosystem, Mathematical models, Laboratory tests, Theoretical analysis, Management, Persistence limits, Survival, Metals, Nutrients, Testing procedures, Ecology, On-site tests, Biological communities.

Determination of persistence limits of disturbed ecosystems on the basis of previous mathematical models, field studies, or laboratory studies seems either inappropriate or inconclusive. Laboratory simulations using experimental microcosms may be the most promising approach. A distrubed system is considered to persist as long as it will revert both structurally and functionally to its orginial state once the distrubance is relaxed. The persistence limit is defined as the distrubed state beyond which effets are irreversible. Persistence limits are a useful management tool since confining anthropogenic distrubances to those limits will insure maintenance of the system or resource. Constraints to these definitions: (1) the unperturbed system must be adequately defined in time and space, has holistic properties, and has multiple inherent stable points; (2) recovery time must be short relative to possible long-term natural changes in equilibrium states (about 1000 yrs); and (3) determination of system changes during distrubance is technology-dependent. Most computer simulation and analytical ecosystem models have been derived from components experimentally isolated from the system, and are therefore not suitable for establishing persistence limits. Field studies have been inconclusive. To date no attempts have been made to determine persistence limits for complex laboratory microcosms. (See also W79-04537). (Lynch-Visconsin)
W79-04548

THE DEVELOPMENT OF STANDARD LABORATORY AND FIELD ECOSYSTEM RESEARCH TO DETERMINE THE EFFECTS OF POLLUTANTS ON THE MARINE ENVIRONMENT,
Moscow State Univ. (USSR). Dept. of Biology.
K. S. Burdin.
In: First American Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 118-125. 1 tab, 11 ref.

Descriptors: *Methodology, *Experimental ecosystem, *Analytical techniques, *Laboratory tests, On-site tests, *Oceans, *Water pollution effects, Environmental effects, Estuaries, Standard methods, Monitoring, Testing procedures, Ecosystems, Pollutants, Biological communities, Research priorities, Nutrients, Toxicity, Simulation analysis.

Research on effects of pollutants on the marine environment may be standardized by means of a proposed series of laboratory and field experiments, and by observing several rules in structuring research programs: (1) laboratory results must be used with caution in describing the condition of the entire ecosystem; (2) a parametric description of higher ecosystem levels does not necessarily also describe constituent components; (3) each level is described with a finite set of systemic parameters whosw measurement is interpreted according to a standard method; (4) standard research methods include a mandatory collection of test organisms cultured under standard conditions and with a detailed description of toxicological methods; (5) research programs must include experiments on various test species, on populations, and using simulated ecosystems (microcosms); (6) laboratory experiments are warrented only when pollution levels are known and effects cannot be established on the basis of ecosystem parameters. Suggested laboratory tests with 1-5 liter microcosms: (1) one or more populations in a chemostat, (2) pure population culture with a closed food cycle, (3) multiple reseedings to obtain a small portion of a natural ecosystem, (4) food chain organisms (including fish), and (5) simulation of all elements of the natural environment. Microcosms of various sizes may be used under field conditions. (See also W79-04537). (lynch-Wisconsin)
W79-04549

IMPACT OF PESTICIDES ON THE MARINE ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
D. J. Hansen.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 126-137. 4 fig, 4 tab, 20 ref.

Descriptors: *Pesticides, *Endrin, *Heptachlor, *Estuaries, *Water pollution effects, *Aquatic animals, *Bioassay, Oceans, Environmental effects, Minnows, Cyprinodon variegatus, Crabs, Shrimp, Lethal limit, Biological communities, Fish, Benthic fauna, Invertebrates, Florida, Methodology, Laboratory tests, Toxicity, Aroclors, Polychlorinated biphenyls, Toxaphene, Poisons, Pollutants, Testing procedures, Palaemonetes pugio.

Laboratory bioassay experiments were conducted to test effects of toxicants on estuarine animals: (1) acute bioassays with flowing water at constant salinity and temperature, and with measurement of toxicant concentation in water and test organisms and statistical analysis of mortality data; (2) bioassays on sensitive larval stages of crabs and shrimp; (3) bioassays over the reproductive period or entire life cycle of grass shrimp (Palacemonetes pugio) and sheepshead minnow (Cyprinodon variegatus); and (4) bioassays on communities of benthic macroinvertebrates. Bioassaying, perhaps the most useful technique available for predicting a chemical's potential hazard, includes acute toxicity experiments (either static or flow-through), usually used to determine the concentration of a chemical lethal to a certain percentage of test organisms over a short time; long-term bioassays on sensitive life stages, used to determine the concentration which can be tolerated by a species through all or part of its life cycle; and community bioassays, for predicting community response to a toxicant. Findings: (1) C. variegatus typically develops from embryo to maturity in 10-14 weeks with about 70% survival in the laboratory, females produce an average of eight eggs/day, and fertilization exceeds 90%; (2) the pesticides endrin and heptachlor reduced spawnings and eggs of C. variegatus, decreased egg fertility, and increased mortality of fry and spawning females. Effects of the pesticide toxaphene and the PCB Aroclor 1254 were also tested. (See also W79-04537). (Lynch-Wisconsin)
W79-04550

OIL AND MARINE ORGANISMS,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
O. G. Mironov.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 138-143. 1 tab, 6 ref.

Descriptors: *Oceans, *Water pollution effects, *Oil pollution, *Oil-oxidizing microorganisms, *Microorganisms, *Methodology, *Bioindicators, Testing procedures, Monitoring, Self-purification, Oil spills, Bacteria, Species diversity, Black Sea, Mediterranean Sea, Seas, Organic compounds.

A relatively low-cost international program for monitoring petroleum-oxidizing microorganisms as indicators of oceanic hydrocarbon pollution is described, based on Soveity investigations in the Back and Mediterranean Seas. The program, which would cost about $5 million for equipment and laboraotry processing of the initial 100 samples, was first presented to the Joint Study of the Mediterranean Sea (JSMS) in 1975. For the minimum program (first stage), the population of hydrocarbon-oxidizing microorganisms in mineral media would be determined with a single source of carbon and energy (crude petroleum and simple phenol) by the method of maximum dilutions on the surface layer, the surface layer plus standard levels and in the surface layer plus standard levels plus the seabed. Test bodies of water would include periodic profiles within a country's territorial waters, permanent coastal stations, expeditions outside the coastal zone, etc. Observations could vary from daily to weekly or monthly. The second stage provides for the isolation of the microorganisms and determination of their hydrocarbon-oxidizing acitivity, permitting calculations of the ocean's capacity for self-purification and prediction of pollution extent. Some of these studies have already begun. Effects of oil pollution are discussed. (See also W79-04537) (Lynch-Wisconsin)
W79-04551

IMPACT OF METALS ON THE MARINE ENVIRONMENT,
Moss Landing Marine Lab., CA.
J. H. Martin.
In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 144-154. 43 ref.

Descriptors: *Oceans, *Heavy metals, *Water pollution effects, *Experimental ecosystems, *Toxicity, Mercury, Selenium, Sea water, Copper, Pollutants, Sea lions, Zalophus californianus, Trace elements, Zooplankton, Phytoplankton, Algae, CEPEX program, Research priorities, Public health, Methodology, Abalone.

Research on heavy metal pollution of the marine environment is still inconcluive although elevated cocentrations of heavy metals have been ecountered in some organisms. However, the threat to human health has been well-documented in cases of mass mercury poisonings in minamatta, Japan, and in Iraq, and cadmium and lead are known human health hazards. Mass mortalities caused by heavy metals have been observed in the marine environment, though they are rare compared with land occurrences. All abalone in a discharge area were killed by elevated copper concentrations in contaminated power plant cooling water. The Controlled Ecosystem Pollution Experiment (CEPEX) program was undertaken to meet the need for tests with realistic levels of various pollutants rather than the high levels generally used in small-scale laboratory experiments. some 70 tons of seawater were enclosed in polyethylene bags placed in Saanich Inlet, Vancouver, British Columbia. In early experiments copper concentrations of one ppb inhibited Chlorella growth and photosynthesis. Photosynthesis in the freshwater diatom Nitzchia palea was also inhibited ata that level. Interactions of metals and organisms are extremely complex and difficult to isolate. (See also W79-04537). (Lynch-Wisconsin)
W79-04552

REPORT OF THE JOINT AMERICAN-SOVIET EXPEDITION ON THE SCIENTIFIC RESEARCH VESSEL 'MOSCOW UNIVERSITY' FOR THE FIRST STAGE OF INTERCALIBRATION OF METHODS FOR THE HYDROBIOLOGICAL ANALYSIS OF AQUATIC ECOSYSTEMS,

Florida State Univ., Tallahassee. Dept. of Oceanography.
R. L. Iverson, K. C. Burdin, V. Maximov, and M. Lymin.

In: First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms, 20-24 September 1976, Gulf Breeze, Florida. Publication No. EPA-600/9-78-007, May 1978, p 156-165. 1 fig, 1 tab, 9 ref.

Descriptors: *International cooperation, *Methodology, *Carbon radioisotopes, *Primary productivity, *Phytoplankton, *Oceans, *Soviet Union, *United States, Hydrobiology, Ecosystems, Atlantic Ocean, Gulf of Mexico, Gulfs, Liquid scintillation, Sampling, On-site tests, Filters, Measurement, Volumetric analysis, Algae, Testing procedures, Analytical techniques, Regression analysis.

American and Soviet methods for measuring phytoplankton productivity were compared during an expedition aboard a research ship in the western Atlantic Ocean and eastern Guld of Mexico in summer 1975, and no consistent difference in carbon-14 activity was found except at one station. At station 9, Synpor membrane filters with a 0.3-micron pore size were used by both Soviet and American researchers (the Americans normally used 24-mm diameter Whatman GF/C glass fiber scintillation grade filters), and American activity was consistently lower than Soviety activity at all depths, suggesting it is necessary to solubilize the Synpor filters in order to minimize radioisotope absorption problems. Anomalously high activity values (e.g. Soviet station 3, and American station 7) were usually characterized by high standard deviations reflecting effects of high activity values for one or two of the three replicate samples; these high values are unexplained, but may result from uneven distribution of phytoplankton between repliates or from problems in correcting for chemiluminescence. Mean coefficient of variation for American carbon-14 activity values was 21 (range 2-123), while Soviet mean was 29 (0-145). Integrated productivity values for each station were treated by linear regression. The regression slope of American Soviet values was not significantly different from 1.0 ($p=0.05$) and the intercept was not significantly different from 0.0 ($p=0.05$), indicating the two sets of methods gave similar values. (See also W79-04537). (Lynch-Wisconsin)
W79-04553

DISTRIBUTION OF STABLE ORGANIC MOLECULES IN THE MARINE ENVIRONMENT: PHYSICAL CHEMICAL ASPECTS. CHLORINATED HYDROCARBONS,

URS Co., Seattle, WA.
R. N. Dexter, and S. P. Pavlou.

Marine Chemistry, Vol 7, No 1, p 67-84, December 1978. 3 fig, 3 tab, 60 ref.

Descriptors: *Water pollution, *Chlorinated hydrocarbons, *Organic compounds, *Environmental effects, Chemical analysis, Pollutant identification, Resources development, *Outer continental shelf, Physical chemistry.

The relative concentrations of non-polar organic compounds in seawater and suspended particulate matter can be explained by an equilibrium sorption mechanism. The value of the quasi-equilibrium constant, K, was calculated with reasonable accuracy for polychlorinated biphenyls from a relatively simple equation which relies on both measurable physical parameters and a number of molecular terms estimated from fundamental physical chemical considerations. This model represents an approach to defining the accumulation of stable organic molecules on marine particulate interfaces within a coherent theoretical framework. As such, it provides a guide for selecting appropriate ecosystem parameters which influence the distribution and accumulation potential of these chemicals in the marine environment. (Sinha-OEIS)
W79-04559

VOLATILE LIQUID HYDROCARBONS IN THE SURFACE COASTAL WATERS OF THE GULF OF MEXICO,

Texas A and M Univ., College Station. Dept. of Oceanography.
T. C. Sauer, Jr., W. M. Sackett, and L. M. Jeffrey.

Marine Chemistry, Vol. 7, No. 1, p 1-16, December 1978. 5 fig, 3 tab, 53 ref.

Descriptors: *Water pollution, *Chemical analysis, *Pollutant identification, *Environmental effects, Gulf of Mexico, Coasts, Dispersion, Evaporation, *Outer Continental shelf, Hydrocarbons, Petroleum hydrocarbons.

A sampling and analysis procedure has been developed to determine quantitatively volatile liquid C6-C14 hydrocarbons, the most immediately toxic components of petroleum hydrocarbons, at the ng/l level characteristically found in marine waters. The method involves dynamic headspace sampling; continuous stripping of volatile hydrocarbons from heated seawater by an ultrapure inert gas, and trapping of volatile components on a solid polyphenyl ether adsorbent, Tenax-GC. Distributions of liquid hydrocarbons were determined in coastal surface waters of the Gulf of Mexico. Total volatile n-alkane concentrations range from 7 ng/l to 50 ng/l, whereas total volatile aromatics (benzene, toluene, ethylbenzene and xylenes) range from 20 ng/l to 450 ng/l. At most sample stations, 80-90% of the total liquid hydrocarbons in surface water is aromatic. The contribution in seawater of these volatile hydrocarbons to the total solvent-extractable hydrocarbon budget is a few percent at most. A direct correlation exists between liquid hydrocarbon concentrations and C1-C5 hydrocarbon concentrations. Surface-water samples which show high liquid hydrocarbon concentrations (500 ng/l) are also extremely high in methane and ethane relative to open-ocean levels. Samples which are lowest in liquid hydrocarbons (30 ng/l) have concentrations of methane and ethane close to baseline or open-ocean concentrations. (Sinha - OEIS)
W79-04560

LES PAPETERIES DU BOURRAY (FRANCE), AN EXAMPLE OF EFFECTIVE TREATMENT OF WASTE WATERS (LES PAPETERIES DU BOURRAY, UN EXEMPLE D'EPURATION EFFICACE DES EAUX RESIDUAIRES).

ATIP (Association Technique de l'Industrie Papetiere) Revue, Vol. 32, No. 4, p 156-159, April, 1978. 6 illus.

Descriptors: *Pulp wastes, *Waste water treatment, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Flocculation, Sedimentation, Sludge treatment, Dewatering, Suspended solids, Treatment facilities, Foreign countries, France, Europe, Clarifiers.

A description is given of the effluent treatment system installed at the Bourray paper mill, which manufacturers mainly writing and printing papers and cellulose wadding from hemp and waste paper raw materials. The system features a clarifier combining flocculation with sedimentation and sludge thickening. In 1977, the station received an average of 10,000 cu m of waste water/day containing 5,000 kg of suspended solids. The concentration of suspended matter in the clarified effluent averages 8 mg/liter (0.9 kg/ton of paper produced). No addition of chemicals is required. Recycling of the clarified water is planned for the future. (Speckhard-IPC)
W79-04561

KINETIC ANALYSIS OF INTERACTIVE EFFECTS OF CADMIUM AND NITRATE ON GROWTH OF THALASSIOSIRA FLUVIATILIS (BACILLARIOPHYCEAE),

Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.

For primary bibliographic entry see Field 5A.
W79-04587

EFFECTS OF HEAVY METALS ESPECIALLY SELENIUM, VANADIUM AND ZIRCONIUM ON MOVEMENT, GROWTH AND SURVIVAL OF CERTAIN ANIMAL AQUATIC LIFE,

Kansas Water Resources Research, Manhattan.
E. C. Bovee.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 563, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, 1978. 26 p, 11 fig, 15 ref. OWRT B-051-KAN(1). 14-34-0001-7159.

Descriptors: *Heavy metals, Protozoa, Bioassay, *Selenium, *Vanadium, *Zirconium, Tetrahymena, Growth rates, Swimming rates.

The heavy metals Selenium (as H2SeO3 and as Na2SeO3), Vanadium (as VOSO4.2H2O) and Zirconium (as ZrOCl2.xH2O) were tested for potential toxicity to the growth and swimming rates of the ciliated protozoan, Tetrahymena pyriformis. Vanadium and Zirconium, as used, were less toxic in small amounts than some other metals previously tested, e.g., Cadmium. Neither inhibited growth significantly at amounts below five parts per million (5 ppm). Selenium as selenous acid (H2SeO3) slightly stimulated growth at 5 to 15 ppm; but as selenite (Na2SeO3) it completely blocked growth at all concentrations tested, 3 to 20 ppm. Vanadium did not affect growth at 3 to 15 ppm, but depressed it in greater amounts. Zirconium at concentrations of 3 to 15 ppm slightly stimulated growth, but depressed it at higher amounts. All three metals, however, inhibited swimming at concentrations over 5 ppm, selenium being the more toxic, stopping swimming in 30 ppm in less than 1 hour. Concentrations of any of the three metals above 20 ppm are detrimental to the growth and survival of Tetrahymena pyriformis. The methods used for analyzing growth and swimming rates are qualitatively useful to detect a dangerous level of a pollutant and the photographic method for analyzing swimming rates may also be a useful quantitative assay for a known pollutant, as well as being a rapid, inexpensive bioassay.
W79-04592

EFFECTS OF LEAD ON GROWTH OF THE MARINE DIATOM SKELETONEMA COSTATUM,

City Coll., New York. Dept. of Biology.
R. B. Rivkin.

Marine Biology, Vol. 50, p 239-247, 1979. 1 fig, 5 tab, 62 ref.

Descriptors: *Growth rates, *Diatoms, *Lead, Toxicity, Heavy metals, Cytological studies, Respiration, Photosynthesis, Chlorophyll, Proteins, Aquatic algae, Carbon, Biochemistry, *Skeletonema, Bioaccumulation.

The growth rate and maximum yield of Skeletonema costatum in batch culture were inhibited by dissolved lead at concentrations of 0.05 to 10.0 micrograms Pb 1-1. Growth rate, maximum yield, and respiration cell-1 decreased and photosynthesis cell-1 and cell volume increased in response to increased lead concentration in the medium. At 0.1 and 1.0 microgram Pb 1-1, the chlorophyll a:carbon and protein:carbon ratios did not significantly differ from the control and the increased cellular chlorophyll a, carbon and protein observed at these concentrations reflect an increased cell volum. However, at 10.0 micrograms Pb1-1, associated with an increase in cell volume, the chlorophyll a:carbon ratio was significantly lower and the protein:carbon ratio was significantly higher than in the control, reflecting a changes cellular chemical composition. The rates of cell division and dark respiration decreased relative to photosynthesis and to carbon and protein production, resulting in an alteration of the cellular chemical composition. (DEAL-EIS)
W79-04600

REQUIREMENT OF RAINBOW TROUT FOR DIETARY MAGNESIUM, (IN JAPANESE),
Tokyo Univ. of Fisheries (Japan). Lab. of Fish Nutrition.
C. Ogino, F. Takashima, and J. Y. Chiou.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 4, No. 10, p 1105-1108, 1978. 8 fig, 4 tab, 5 ref. (English abstract).

Descriptors: *Nutrient requirements, *Rainbow trout, *Fish diets, *Magnesium, *Calcium, Nutrients, Laboratory tests, Diets, Growth rates, Fish behavior, Pathology, Microscopy, Trout, Salmonids, Fish farming, Aquiculture, Commercial fish, Fish management, *Salmo gairdneri, Histology.

Rainbow trout weighing 0.9 g on the average were fed purified diets containing different amounts of Mg for 6 weeks. The concentration of Mg in the rearing water was 3.1 ppm. Dietary Mg levels were found to affect not only the appetite, growth, and movement of the fish but also the contents of ash, Mg, and Ca of the whole body and of the vertebrae. The occurrence of vertebral curvature was also recognized in the fish which received the Mg-dificient diet. The values for Ca/Mg of the whole body and of the vertebrae changed according to the dietary Mg levels. Histological changes were recognized in the muscle, pyrolic caeca, and gill filaments from the fish fed the Mg-deficient diet. The requirement of rainbow trout for dietary Mg was estimated to 0.06-0.07% of a dry diet or 12-16 mg per 1 kg body weight per day under the present experimental conditions. (Katz-EIS)
W79-04601

THE INFAUNAL BENTHOS OF A NATURAL OIL SEEP IN THE SANTA BARBARA CHANNEL,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 5B.
W79-04624

EFFECT OF ENRICHMENT WITH DIGESTED NIGHT SOIL ON THE GROWTH OF MARINE PLANKTON (IN JAPANESE),
Yamanashi Univ., Kofu (Japan). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5B.
W79-04626

NO. 2 FUEL OIL DECREASES EMBRYONIC SURVIVAL OF GREAT BLACK-BACKED GULLS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
N. C. Coon, P. H. Albers, and R. C. Szaro.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 152-156, 1979. 2 tab, 11 ref.

Descriptors: *Oil, *Mortality, *Gulls, *Bird eggs, Oil spills, Oil pollution, Organic compounds, Clutch, Nests, Water birds, Toxicity, Incubation, Hatching, Bioassay.

Two concurrent studies are reported in which eggs of the great black-backed gull were externally contaminated with No. 2 fuel oil. In the first experiment, performed entirely in the wild, 90 clutches of eggs were randomly assigned to three groups. Two groups were treated with either 5 microliters or 20 microliters of No. 2 fuel oil. The third group served as the control. The clutches treated wth 20 microliters of oil per egg had significantly poorer survival rate at 8 days post treatment than the control clutches. Survival rate did not differ between control and 5 micro-liter-treated clutches. The second experiment consisted of the same three treatment groups, except it was performed on laboratory-incubated eggs. There was significantly more mortality in both the 20 and 5 microliter-treated groups at the end of 18 days as compared to controls. This artificial incubation bioassay is useful in predicting the effects of environmental contaminants on bird productivity. (DEAL-EIS)
W79-04628

INCREASED SPONTANEOUS LOCOMOTOR ACTIVITY IN THE FIDDLER CRAB, UCA PUGILATOR, AFTER EXPOSURE TO A SUBLETHAL CONCENTRATION OF DDT,
Tulane Univ., New Orleans, LA. Dept. of Biology.
S. W. Fingerman, C. V. Meter, Jr., and M. Fingerman.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 11-16, 1979. 2 fig, 8 ref.

Descriptors: *DDT, *Crabs, *Animal behavior, Chlorinated hydrocarbon pesticides, Biorhythms, Insecticides, Pesticide residues, Pesticide toxicity, Chemical properties, Animal physiology, Temporal distribution, Circadian rhythm.

The objectives were to determine the effect of DDT on the level spontaneous locomotor activity throughout a 24 hr day and whether DDt alters the circadian pattern of this activity. Crabs were exposed to 0.08ppm DDT for three days. DDT produced an increase in the spontaneous locomotor activity of these fiddler crabs. The circadian nature of their activity appeares not to have been affected. (Deal-EIS)
W79-04629

BIOSOLIDS AS FOOD,
Institute of Paper Chemistry, Appleton, WI.
E. F. Zanella.
In: Proceedings of The Institute of Paper Chemistry (Appleton, Wisconsin) 42nd Executives Conference, May 10-11, 1978. p 28-31, 2 fig.

Descriptors: *Pulp wastes, *Foods, *Aquatic microorganisms, Suspended solids, Wastes, Industrial wastes, Digestion, Caddisflies, Daphnia, Aquatic life, Biological treatment, Waste water treatment, Pulp and paper industry, Effluents, Aquatic insects, Path of pollutants.

Experimental techniques are discussed for demonstrating the ingestion and assimilation of nonsettleable solids in pulp and paper mill effluents by aquatic organisms. Mill biosolids supported the growth of large caddis fly (Hydropsyche walkeri) larvae and both the growth and reproduction of Daphnia. Thus, the discharge of biosolids to receiving streams may have a beneficial or at least neutral effect on the animal life, and for this reason it is felt that solids which can be used as food may not warrant removal by expensive and complicated waste treatment beyond current levels of secondary biological treatment. (Brown-IPC)
W79-04638

RESPONSE OF EURYTHERMAL AND STENOTHERMAL FISH SPECIES TO CHLORINATED DISCHARGES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-04651

A COMPUTER MONITORED AQUATIC BIOASSAY SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-04652

ON THE ESTIMATION OF THE ANTHROPOGENIC POLLUTION EFFECT ON THE FUNCTIONAL STATE OF THE SOIL MICROFLORA,
Institute of Experimental Meteorology, Obninsk (USSR).
E. I. Gaponyuk, and V. A. Kobzev.
In: Symposium on Environmental Transport and Transformation of Pesticides, October, 1976, Tbilis, USSR. EPA-600/9-78-003, p 86-97, February, 1978. 2 fig, 2 tab, 13 ref.

Descriptors: Industrial wastes, Agricultural chemicals, Pesticides, *Pesticide toxicity, *Soil microorganism, Soil microbiology.

Experiments were conducted in Russia to estimate the anthropogenic pollution effect on the functional state of the soil microflora. The dehydrogenase activity was chosen as a criterion for evaluating the effect of industrial and agricultural toxicants on the biological activity of soil microflora. The toxic effect of high concentrations of heavy metals in soils of industrial regions was found to be greater than that of pesticides. The experimental results indicate that the toxic effect of chlororganic pesticides on the soil microflora may be accounted for by the disturbance of the dehydration processes which are of energetic value for the cell. And the decrease in the dehydrogenase activity may lead to a decrease in the biotransformation processes associated with it. (Skogerboe-Colorado State)
W79-04657

RESEARCH ON PULP AND PAPER INDUSTRY WATER AND EFFLUENT QUALITY PROBLEMS -- A REVIEW,
British Columbia Research Council, Vancouver.
C. C. Walden, T. E. Howard, and J. C. Mueller.
In: Canadian Pulp and Paper Association Technical Section, Spring Conference, May 17-21, 1978, Jasper, Alberta, Preprinted Proceedings, p. 55-64. 5 fig, 4 illus, 58 ref, 3 tab.

Descriptors: *Water quality, *Pulp and paper industry, *Water pollution effect, Wastes, Industrial wastes, Water pollution sources, Pulp wastes, Fish, Aquatic animals, Aquatic life, Toxicity, Biological treatment, Foam fractionation, Separation techniques, Suspended solids, Environmental effects, Color, Microbiology, Aquatic microbiology, Canada, Foreign countries, Waste water treatment, Water pollution treatment, Detoxification.

Since 1966 the British Columbia Council of Forest Industries and North Western Pulp and Power Ltd. (Alberta) have sponsored research programs in water quality problems. These programs are outlined. They concern the sublethal impacts of kraft effluents on fish. The removal of effluent toxicity by biological treatment and foam fractionation, the formation and environmental impact of suspended solids, the microbiological characteristics of pulp mill effluents, the environmental impact of color, and in-plant toxicity studies and avoidance. (Swichtenberg-IPC)
W79-04668

DISSOLVED OXYGEN DEMAND OF REDUCED CHEMICAL SPECIES IN THE WATER COLUMN OF SEBASTICOOK LAKE, MAINE,
Maine Univ. at Orono.
For primary bibliographic entry see Field 2H.
W79-04684

STUDIES ON THE POST-MORTEM IDENTIFICATION OF THE POLLUTANT IN FISH KILLED BY WATER POLLUTION - XIII CADMIUM (IN JAPANESE),
Tohoku Univ., Sendai (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W79-04694

COMPARISON OF A HIGH VOLUME PUMP AND CONVENTIONAL PLANKTON NETS FOR COLLECTING FISH LARVAE ENTRAINED IN POWER PLANT COOLING SYSTEMS,
Lockheed Center for Marine Research, Carlsbad, CA.
For primary bibliographic entry see Field 5A.
W79-04703

ECONOMICS OF ON-FARM METHODS OF CONTROLLING SEDIMENT LOSS FROM SURFACE-IRRIGATED FIELDS,
For primary bibliographic entry see Field 4D.
W79-04756

PRODUCTS OF PHOTOSYNTHESIS IN NATURAL POPULATIONS OF MARINE PHYTOPLANKTON FROM THE GULF OF MAINE,

Bigelow Lab. for Ocean Science, West Boothbay Harbor, ME.
I. Morris, and W. Skea.
Marine Biology, Vol. 47, No. 4, 303-312, 1978. 9 fig, 26 ref. NSF DES75-15104, ERDA AT (11-1) 3024.

Descriptors: *Phytoplankton, *Marine algae, *Atlantic Ocean, *Carbon radioisotopes, *Photosynthesis, Gulf of Maine, Algae, Maine, Proteins, Photosynthetic products, Eutrophication, Darkness, Light intensity, Seasonal, Depth, Carbon dioxide, Methodology, Biochemistry, Oceans, Polysaccharides, Analytical techniques, Trichloroacetic acid, Boothbay Harbor(ME).

Measurements were made of photosynthetic assimilation of carbon-14 carbon dioxide by natural marine phytoplankton populations at three sites in the Atlantic Ocean off the northeastern U.S. coast (Gulf of Maine) into: (1) ethanol-soluble, (2) hot-trichloroacetic acid (TCA)-soluble (polysaccharide), and (3) protein fractions. Diurnal studies were conducted 1975 at Jeffery's Ledge and Great South Channel, and a seasonal study 12 km south of Boothbay Harbor, Maine. Diurnal studies showed continuing incorporation of carbon-14 into the protein fraction in darkness, accompanied by a decrease in the proportion assimilated into polysaccharide. Photosynthesis pattern did not vary by time of day. At the station south of Boothbay Harbor, marked seasonal changes occurred in the proportion of carbon entering protein; in winter about 10-20% of fixed carbon was incorporated, while in summer it was 22-35%. During spring bloom a transient high value of 37-47% occurred. The proportion of carbon incorporated during photosynthesis increased markedly at reduced light intensities, both when populations were incubated with neutral-density filters and at increasing depths in the photic zone. The increased relative rate of protein synthesis at lower light intensities depended on the nutrient state of the phytoplankton. (Lynch-Wisconsin)
W79-04763

THE BIOLOGY, ECOLOGY, AND BEHAVIOR OF THE BIVALVE MYSELLA BIDENTATA (MONTAGU),
K. W. Ockelmann.
Ophelia, Vol. 17, No. 1, p 1-93, July 1978. 20 fig, 10 tab, 87 ref.

Descriptors: *Mysella bidentata, *Amphiura filiformis, *Bivalves, *Life history studies, *Growth stages, *Reproduction, Amphiura chiajei, Symbiosis, Scandinavia, Mollusks, Marine biology, Ecology, Behavior, Classification, Monticutidae, Invertebrates, Benthic fauna, Ophiuroidea, Echinoderms, Oresund, Atlantic Ocean, Oceans, Distribution, Clams, Mortality, Predation, Fertility, Morphology, Model studies, Straits.

Behavior, reproduction, spatial distribution, growth, mortality, feeding, and functional morphology of the boreal-lusitanian east Atlantic bivalve Mysella bidentata (3.1-3.9 mm) are described, with information on the ophiuroid echinoderm Amphiura M. bidentata distribution positively correlates with adult A. filiformis density in the northern Oresund between Denmark and Sweden. In the laboratory the euryvalent M. bidentata prefers to live in oxidized layers around the burrow of Amphiura. Dense Amphiura populations enlarge the water-sediment interface and thereby the oxidized layers and microbial activity, benefitting Mysella which obtains protection from surface-hunting predators and additional food supply. The bivalves are functional males in their second year, and at three years and three mm long they are hermaphrodites. Males produce fertile and oligopyrene sperm simultaneously; as sperm transfer involves sperm bags and receptacula seminis, it is time-independent of egg spawning. Mysella reacts to gravitation by positive or negative body movement and to direction of water flow by positive turning movement. Chemical stimuli from a predator, Astropecten, evoke direct orthokinesis, while stimuli from the host Amphiura evoke direct orthokinesis and direct klinokinesis. A model, adaptable to other species, links responses and behavioral patterns in Mysella to physiological functions, survival mechanisms, site selection, and intraspecific regulation. (Lynch-Wisconsin)
W79-04764

ASPECTS OF WATER COLUMN PRIMARY PRODUCTIVITY IN THE CHUKCHI SEA DURING SUMMER,
Science Applications, Inc., Boulder, CO.
M. J. Hameedi.
Marine Biology, Vol. 48, No. 1, p 37-46, 1978. 2 fig, 1 tab, 44 ref. Wash. U., Applied Physics Lab. NR 307 357. U.S. Navy N00014-75-C-0187.

Descriptors: *Chukchi Sea, *Primary productivity, *Summer, *Chlorophyll, *Phytoplankton, *Arctic Ocean, Oceans, Seas, Cold regions, Alaska, Siberia, Solar radiation, Limiting factors, Nitrogen, Phosphorus, Silicates, Phosphates, Nutrients, Salinity, Water temperature, Equations, Shade, Algae.

Phytoplankton productivity, chlorophyll distribution, and related processes during July 1974 in the marginal ice zone of the Chukchi Sea north of the Bering Straits in the Arctic Ocean showed low to moderate primary productivity levels (0.07-0.97 g C/sq m/half-day), and nitrogen-limited surface primary productivity at most stations. Primary productivity exceeded three g C/sq m/half-day at two stations. Mean chlorophyll-a concentration in the photic zone varied 0.4-17.8 mg/cu m. In July, higher concentrations of chlorophyll-a, reaching 40 mg/cu m, were observed at stations near the ice-edge than in open water, along with significant subsurface accumulation. No chlorophyll maximum was noted in September, when values ranged 0.4-2.2 mg/cu m. The contribution of sea-ice algae to total chlorophyll content may be substantial, but these cells may not remain long in the water column. Nonlinear regression estimates from solar radiation and chlorophyll-specific primary productivity data showed a maximal photosynthetic rate of 18 mg C/mg chlorophyll-a/half-day, an optimal light intensity of 54 langleys/half-day, and markedly reduced primary productivity at moderately higher light intensities, indicating shade-adaptation by phytoplankton. The two equations used to describe the photosynthesis-light relationships (by Steele and Vollenweider) described the data well, though the Vollenweider equation underestimated the observed specific photosynthesis by a small but significant amount. (Lynch-Wisconsin)
W79-04765

STUDIES ON 14CO2-ASSIMILATION IN MARINE RHODOPHYCEAE,
Cologne Univ. (Germany, F.R.). Botanisches Inst.
B. P. Kremer.
Marine Biology, Vol. 48, No. 1, p 47-45, 1978. 7 fig, 30 ref.

Descriptors: *Rhodophyceae, *Carbon dioxide, *Photosynthesis, *Assimilates, *Photocynthetic products, *Biochemistry, Algae, Marine algae, Enzymes, Darkness, Carbon radioisotopes, Kinetics, Carbon, Porphyra umbilicalis, Rhodomela confervoides, Corallina officinalis, Chorndrus crispus, Gigartina stellata, Rhodymenia palmata, Delesseria sanguinea, Ceramium rubrum, Polysiphonia urceolata, Ribulose-1,5-diphosphate carboxylase, Floridoside.

Nine marine species of Rhodophyceae belonging to different orders were used in studies of carbon-14 carbon dioxide assimilation and kinetics of carbon-14 labelling of typical assimilates. Purposes were to: (1) determine the biosynthesis of the assimilates in reaction to CO2-fixation, (2) evaluate their biochemical significance, and (3) compare their function with the low-molecular weight assimilates of other algal classes. Results showed that carbon assimilation in Rhodophyceae is almost exclusively performed by photosynthesis via ribulose-1,5-di-phosphate carboxylase, whereas light-independent (dark) CO2-fixation via beta-carboxylation by phosphoenolpyruvate carboxykinase scarcely exceeds 1% of the total carbon fixation potential of the plants. Activity of phosphoenolpyruvate carboxylase could not be detected. The species were not uniform with respect to the main accumulation products of photosynthesis CO2-fixation; Corallina officinalis, Rhodymenia palmata, and Gigartina stellata accumulated carbon-14 in the neutral compound floridoside, whereas Delesseria sanguinea, Ceramium rubrum, and Rhodomela confervoides (representing the Delesseriaceae, and Rhodomelaceae) do not photosynthesize floridoside, but show intense carbon-14 labelling in an acidic constituent, mannosidoglycerate, also reported for the first time as a rapidly carbon-14 labelled and accumulated photosynthate in several species belonging exclusively to the Ceramiales. Other species studied were Porphyra unbilicalis, Chondrus crispus, and Polysiphonia urceolata. (Lynch-Wisconsin)
W79-04766

LIFE CYCLES AND POPULATION DYNAMICS OF MARINE BENTHIC BIVALVES FROM THE DISKO BUGT AREA OF WEST GREENLAND,
Zoologisk Museum, Copenhagen (Denmark).
G. H. Petersen.
Ophelia, Vol. 17, No. 1, p 95-120, July 1978. 18 fig, 6 tab, 17 ref.

Descriptors: *Bivalves, *Disko Bugt(Greenland), *Life cycles, *Population dynamics, *Life history studies, Greenland, Productivity, Biomass, Energy, Reproduction, Parasitism, Seasonal, Settling, Benthic fauna, Faunal lists, Mollusks, Analytical techniques, Suspension feeders, Deposit feeders, Ecology, Mytilus edulis, Serripes groenlandicus, Macoma balthica, Macoma calcarea, Nucula tenuis, Cardium ciliatum, Hiatella byssifera, Mya truncata.

Eight of 24 bivalve species collected 1958-60 in the Disko Bugt area of west Greenland were studied with regard to life cycles and population dynamics: Nucula tenuis, Mytilus edulis, Serripes groenlandicus, Cardium cilitatum, Macoma calcarea, M. balthica, Hiatella byssifera, and Mya truncata. Distribution and abundance of all 24 species are presented in a table. Biomass and production were highest for suspension feeders in a shallow, exposed locality, and almost negligible in a deep, sheltered locality, where deposit feeders predominated. Samples were collected from the exposed shell gravel locality Udkiggen (80-100 m) and from four Godhavn sites: (1) Godhavn Havn, 3-13 m (exposed, shallow); (2) Lyngmarksbugt, 25-42 m (exposed, deep); (3) Fangsthytten, 3-18 m (sheltered, shallow); and (4) Tut, 80-107 m (sheltered, deep). In all about 15,000 specimens were collected with a 0.1-sq m van Veen grab. Weight of gonad output was estimated at 1-5% of biomass, and the weight of the settling larvae was about twice the weight of the recruitment to age I. Differences in biomass and production between the localities is the result of gains and losses of energy for the subpopulations at each locality. Favorable factors for growth and production include high food supply, low temperature, and hydrodynamic forces utilizable for food uptake and respiration. Several cases of parasitism were recorded. (Lynch-Wisconsin)
W79-04767

NOTES ON FRESHWATER RED ALGAE FROM WEST MALAYSIA,
Kobe Univ. (Japan). Dept. of Biology.
S. Kumano.
The Botanical Magazine Tokyo, Vol. 91, No. 1022 June 1978. p 97-107. 7 fig, 22 ref.

Descriptors: *Malaysia, *Rhodophyta, *Classification, *Swamps, *Rivers, *Algae, *Systematics, Ballia pinnulata, Batrachospermum beraense, Batrachospermum cylindrocellulare, Batrachospermum tortuosum, Batrachospermum vagum, Calogolossa ogasawaraensis var latifolia, Tuomeya gibberosa, Hildenbrandia rivularis, Sirodotia delicatula, Tasek Bera(Malaysia), Gombak River(Malaysia), Cherok River(Malaysia), Semantan River(Malaysia), Marong Kanan River(Malaysia), Lake Bera(Malaysia), Brackish water, Cytological studies, Floral lists.

Nine species of freshwater red algae were collected 1970-73 in western Malaysia as part of a joint Malaysia-Japan project; five species and one variety are described as new taxa, and three are first records for Malaysia. New taxa are Ballia pinnuata, Batrachospermum beraense, B. cylindrocellulare, B. tortuosum, Caloglossa ogasawaraensis var. atifolia, and Tuomeya gibberosa. New Malaysian records are Batrachospermum vagum, Hildenbrandia rivularis, and Sirodotia delicatula. The algae were collected chiefly in three types of water: (1) brackish water (Tasek Bera, a swamp in northern Paghang), (2) white water (Marong Kanan, a small rivulet running through the virgin Pasoh Forest Reserve in northern Negeri Sembilan), and (3) clear water (the Gombak River, running from a mountain ridge to the vicinity of Kuala Lumpur, and the Cherok and Semai Rivers, branches of the Balong Padang River. Materials were preserved either dried from herbarium specimens or preserved in 10% formalin and in aceto-alcohol solutions for cytological studies. Water pH values were determined by a colorimetric method. The Tasek Bera, surrounded by virgin swamp forests, comprises a series of marshes separated by small swamps but interconnected by narrow rivulets; its water is dark brown, and ranges 23.8-26.9 C and 4.7-5.3 pH. Water temperature of the Marong Kanan was 24.7 C in April 1971. The three clear-water rivers were 23-26 in May-June, and 6.8-6.9 pH. (Lynch-Wisconsin)
W79-04768

VARIABILITY IN ZOOPLANKTON BIOMASS DISTRIBUTION IN THE NORTHERN SARGASSO SEA: THE CONTRIBUTION OF GULF STREAM COLD CORE RINGS,
Woods Hole Oceanographic Institution, MA.
P. B. Ortner, P. H. Wiebe, L. Haury, and S. Boyd.
Fishery Bulletin, Vol. 76, No. 2, p 323-334, April 1978. 2 fig, 7 tab, 32 ref. ONR N00014-66-C-0240, N00014-24-C-0262, NR083-004, NSF DES 74-2783A1.

Descriptors: *Zooplankton, *Cold core rings, Sargasso Sea, *Distribution, *Ocean currents, Biomass, Gulf Stream, Atlantic Ocean, Oceans, Slope water, Phytoplankton, Algae, Primary productivity, Deep water, Organic matter, Diel migration, Biorhythms, Hydrology, Hydrography, Food chains, Standing crops, Seas.

Zooplankton of the northern Sargasso Sea (Atlantic Ocean) are more heterogeneous than previously recognized, due to incursion of Gulf Stream cold core rings. Such rings are mesoscale hydrological features 150-300 km in diameter and up to several thousand meters deep, formed when southerly directed meanders of the Gulf Stream are strong enough to separate from the stream and move south, the remnant enclosing a core of cold and relatively fresh slope water. At a given time there are likely to be 10-15 rings which may cover 6-13% of the 3.3 million-sq km northern Sargasso Sea and which are more productive than the surrounding sea. They have a zooplankton biomass intermediate between the Sargasso Sea and the slope water. Cold corerings may augment primary productivity 3-7%, and zooplankton standing crop 5-16%. An unusually large number of the biomass in rings is found at depths greater than 200 m, in comparison with the surrounding sea or the parent slope water. This distribution may be related to hydrographic and biological changes associated with ring decay. Rings may provide a disproportionately large fraction of the total supply of organic matter to the northern Sargasso deep sea because of their higher productivity, differences in vertical biomass structure, and possibly lower food chain efficiency than that of the Sargasso Sea. Most of the data was collected on cruises in August and November 1975. Ring-D was sampled, formed in February 1975. (Lynch-Wisconsin)
W79-04769

CONTINUOUS STANDARD WATER DELIVERY SYSTEM FOR BIOASSAYS WITH AQUATIC ORGANISMS,
Rijksinstituut voor Drinkwater-voorziening, Leidschendam (Netherlands).
W. Slooff, E. Rab, and T. B. Spierenburg.
The Progressive Fish-Culturist, Vol. 40, No. 3, p 112-114, July 1978. 2 fig, 4 ref.

Descriptors: *Bioassay, *Methodology, *Testing procedures, *Water delivery, *Water purification, Laboratory tests, Water pollution effects, Toxicity, Poisons, Pollutants, Automation, Salts, Filtration, Continuous flow.

A reliable automatic system for purifying and reconstituting bioassay test water is presented. Effects of pollutants on aquatic organisms can only be determined in test water of acceptable quality. Surface water does not meet bioassay requirements because of quality variability and because substances may be present that can induce toxic effects of test organisms or influence the test effect of a toxicant under investigation. Ordinary municipal water often contain chlorine or chloramine which are highly toxic to aquatic organisms. Dissolved solids in groundwater can also disturb bioassays. The purification system described here consists of: (1) dechlorination of tap water by carbon filtration; (2) temperature control using a boiler, refrigeration, and a temperature regulator; and (3) water purification with a 30-micrometer filter, DKV-3.5 automatic softeners, two hollow-fiber reverse-osmosis units with front 10-micrometer filters, and a mixed-bed ion exchange. The system delivers highly purified water at up to 900 1/hr. Certain amounts of several chemicals must be added to the purified water prior to bioassay; apparatus for this purpose is described which utilizes valves and tanks. This system also permits use of toxicant injectors to create constant toxicant levels. (Lynch-Wisconsin)
W79-04770

HETEROTROPHIC UTILIZATION OF ORGANIC CARBON IN AQUATIC ENVIRONMENTS,
Tennessee Univ., Memphis. Dept. of Biochemistry.
G. S. Sayler, and C. M. Gilmour.
Journal of Environmental Quality, Vol. 7, No. 3, p 385-391, 1978. 12 fig, 1 tab, 22 ref.

Descriptors: *Dissolved organic carbon, *Carbon, *Bacteria, *Heterotrophic organisms, *Eutrophication, *Reservoirs, *Growth rates, Idaho, Spring Valley Reservoir(ID), Sworshak Reservoir(ID), Trophic level, Bioassay, Water pollution effects, Respiration, Glucose, Metabolism, Cycling nutrients, Vitamins, Nitrogen, Phosphorus, Nutrients, Sewage.

Samples of waste water and water from two eutrophic Idaho reservoirs showed that dissolved organic carbon (DOC) concentration regulates rate and net response of heterotrophic bacterial growth and activity in aquatic environments, assuming no deficiencies in other essential nutrients. Organic carbon concentrations of sewage samples and water samples from Dworshak and Spring Valley Reservoirs were determined by a modified persulfate wet combustion method. DOC levels reflect net trophic conditions unique to individual sampling locations, and are therefore useful in eutrophication and pollution assays. A direct linear relationship existed between heterotrophic activity and the concentration of available DOC. Significant responses to heterogenous carbon substrates were detected at concentrations common to pristine, low DOC water. Oxygen uptake was more sensitive for measuring heterotrophic bacterial response to simulated DOC enrichment than carbon dioxide evolution, substrate utilization, or biomass production. Results indicated growth factors or vitamin limitations occurred in some aquatic samples. Electrolytic respirometry was used to assess heterotrophic respiration responses to DOC in natural and enriched water samples. Concentration ranges of dissolved organic carbon furnished by sewage and glucose supplemented with micronutrients were incorporated into natural water samples. (Lynch-Wisconsin)
W79-04771

SEASONAL GROWTH AND SUCCESSION OF TROPICAL AND INTRODUCED PHYTOPLANKTON CULTURED IN DEEP SEA WATER,
Marine Biology Station, Arraial do Cabo (Brazil).
Y. Y. Braga, and L. D. Druehl.
Aquaculture, Vol. 14, No. 1, p 1-12, May 1978. 4 fig, 5 tab, 14 ref.

Descriptors: *Aquiculture, *Dominant organisms, *Phytoplankton, *Deep water, *Nutrients, *Diatoms, Seasonal, Pennate diatoms, Species composition, Algae, Oceans, Atlantic Ocean, Brazil, Arraial do Cabo(Brazil), Floral lists, Carbon, Primary productivity, Urea, Superphosphate, Phosphates, Platymonas, Dunaliella tertiolecta, Skeletonema costatum, Phaeodactylum tricornutum, Chrysophyta, Abundance, Plant growth, Succession, Tropical regions.

As part of the Cabo Frio Project, an aquiculture system being developed on the Atlantic Coast in the vicinity of Arraial do Cabo, east of Rio de Janeiro, Brazil, experiments were conducted 1975-76 to determine seasonal phytoplankton dominance in relatively nutrient-rich seawater pumped from a depth of 42 meters and held in concrete tanks. The seawater is used to support growth of shrimp and oysters, which require phytoplankton, and fish, which do not. Indigenous phytoplankton will serve either as a nutrient source, as a competitor to introduced phytoplankton, or as a fouling agent. Culturing conditions: (1) indigenous phytoplankton in unaltered deep-sea water, (2) indigenous phytoplankton in deep-sea water enriched with urea and superphosphate, and (3) deep-sea water inoculated with either Platymonas sp., Dunaliella tertiolecta, Skeletonema costatum, or Phaeodactylum tricornutum. Productivity estimates were assessed by particulate carbon. Results: (1) pennate diatoms dominated indigenous populations throughout the year, though species composition changed; (2) introduced species generally grew well, but all gave way to the natural populations after an early bloom, except Phaeodactylum, which inhibited development of, or eliminated, natural diatom populations; (3) maximum cell concentrations only once fell below 100 million cells/1; and (4) greatest growth occurred in nutrient-enriched cultures (mean 710 million cells/1), compared with a mean of 280 million cells/1 in unaltered seawater. (Lynch-Wisconsin)
W79-04772

THE PRODUCTIVITY OF MESOCYCLOPS LEUCKARTI (CLAUS) IN LAKE KINNERET (ISRAEL),
Kinneret Limnology Lab., Tiberias (Israel).
M. Gophen.
Hydrobiologia, Vol. 60, No. 1, p 17-22. July 1978. 2 fig, 4 tab, 26 ref.

Descriptors: *Lake Kinneret(Israel), *Productivity, *Mesocyclops leuckarti, *Life history studies, *Growth stages, *Growth rates, Biomass, Respiration, Israel, Lakes, Zooplankton, Instars, Copepodids, Nauplii, Water temperature, Metabolism, Food habits, Feeding rates.

Growth dynamics of the copepod Mesocyclops leuckarti were studied in Lake Kinneret, Israel, one of the few lakes in which M. leuckarti is dominant. The organism is widely distributed in lakes of varying salinity, temperature, and associated organisms, reflecting its high adaptability. In Lake Kinneret specific growth rate of young male instars varied 0.03-0.26 micrograms wet wt/microgram wet wt/day at 15 and 22 C, and that of young female instars 0.03-0.17 micrograms, while at IV-V copepodid stages females had the higher rates. During 1969-75 productivity averaged 44 (+ or -23) g wet wt/sq m/mo (five g dry wt), and monthly productivity/biomass (P/B) ratios averaged 3.1. P/B ratios were highly correlated (r squared = 0.98) with temperature changes. Metabolic parameters and P/B ratios were similar to other water bodies, demonstrating M. leuckarti's adaptability. Productivity was calculated on the basis of average number of individuals (nauplii, copepodids, adult females) collected in routine samples, average epilimnetic temperatures, experimental growth rates at 15, 22, and 27 C as averages for male and female nauplii and copepodids, and

potential egg-production of adult females as their productivity measure (adult male productivity was taken as zero). Respiration and food intake were the metabolic parameters. (Lynch-Wisconsin)
W79-04773

PHOSPHORUS AND NITRATE RUN-OFF IN HILL PASTURE AND FOREST CATCHMENTS, TAITA, NEW ZEALAND,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.
R. H. S. McColl, F. White, and A. R. Gibson.
New Zealand Journal of Marine and Freshwater Research, Vol. 11, No. 4, p 729-744, December 1977. 2 fig, 4 tab, 24 ref.

Descriptors: *Phosphorus, *Nitrates, *Watersheds(Basins), *Forest watersheds, *Pastures, *Surface runoff, *Taita experimental basin(New Zealand), Runoff, Agricultural runoff, Streamflow, Floods, New Zealand, Nitrogen, Nutrients, Water pollution sources, Hutt Valley(New Zealand), Streams, Regression analysis, Ammonium.

Nutrient losses in runoff from four watersheds of the Taita Experimental Basin on the eastern side of New Zealand's Hutt Valley in 1971-1973 were highly dependent on floods and were therefore very spasmodic. This pattern must influence plant growth in receiving waters, a factor generally overlooked. Up to 83% of nitrate losses and an estimated 47-70% of phosphorus losses occurred during two large floods. In a hill pasture catchment 48% of nitrate and 31% of phosphorus were apparently lost during a single flood. Less than 20% of phosphorus losses and as little as 1% of nitrate losses occurred during low flows. At low flows, the hill pasture (fertilized with lime at 630 kg/ha/yr and superphosphate at 380 kg/ha/yr) tended to lose more nutrients than the forested land, but differences were small. During large floods, the hill pasture lost about three times as much reactive phosphate and 2-5 times as much total phosphorus as the forested land, and 130-190 times as much nitrate as two of the forest watersheds. Losses of total phosphorus via watershed streams were estimated at 293 h/ha/yr for the hill pasture, 124-201 g for two native watersheds, and 71 g for a non-native conifer watershed, and nitrate-nitrogen losses at 1356 g, 11.5-1436 g, and 44 g, respectively. (Lynch-Wisconsin)
W79-04774

A COMPARISON OF METHODS FOR MEASURING PRIMARY PRODUCTIVITY AND COMMUNITY RESPIRATION IN STREAMS,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
T. L. Bott, J. T. Brock, C. E. Cushing, S. V. Gregory, and D. King.
Hydrobiologia, Vol. 60, No. 1, p 3-12, 1978. 1 fig, 5 tab, 29 ref. BMS75-07333.

Descriptors: *Methodology, *Primary productivity, *Metabolism, *Respiration, *White Clay Creek(PA), *Streams, Measurement, Analytical techniques, Testing procedures, On-site tests, Chambers, Algae, Benthic flora, Diatoms, Chlorophyll, Community respiration, Carbon dioxide, Oxygen exchange, Gas exchange, Standing crops, Diffusion, Alkalinity.

Simultaneous measurement of community metabolism (primarily benthic diatoms) in White Clay Creek, Chester County, Pennsylvania, using five assessment methods yielded variable results. Chamber techniques gave estimates of primary productivity per unit of photosynthetic material which differed two- to four-fold, but which were within an expected range when normalized for chlorophyll-a. Open-stream carbon and oxygen metabolism estimates were complicated in this habitat by high diffusion rates, and metabolic balances determined from these methods were consistently lower than with the chamber methods. Techniques incorporating a recirculating chamber offer the most attractive method for measuring metabolism in high-gradient streams. Methods tested: (1) open-system oxygen method, (2) open-system carbon dioxide method, (3) oxygen change in chambers embedded in the stream bottom, (4) oxygen change in chambers on the stream bank, and (5) carbon dioxide change in chambers in-situ with recirculating water. Balances of photosynthesis and respiration from the chamber methods were similar between methods, indicating that autotrophic or heterotrophic processes could dominate the system. Though diffusion rates of carbon dioxide are usually lower than diffusion rates of oxygen, degree of saturation must be considered when applying the carbon dioxide method; low-order streams may be oversaturated with carbon dioxide. When chamber methods are used, considerable replication is required to compensate for the heterogeneity of lotic systems. (Lynch-Wisconsin)
W79-04775

NITROGEN-FIXATION IN THE LITTORAL BENTHOS OF AN OLIGOTROPHIC LAKE,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
R. E. Moeller, and J. P. Roskoski.
Hydrobiologia, Vol. 60, No. 1, July 1978, p 13-16. 1 fig, 1 tab, 18 ref.

Descriptors: *Nitrogen fixation, *Cyanophyta, *Mirror Lake(NH), *Oligotrophy, *Benthic flora, *Epiphytes, *Periphyton, Nitrogen cycle, Nutrients, Lakes, Acetylene reduction, Nitrogen, New Hampshire, Algae, Assay, Littoral, Macrophytes, Benthos, Lobelia dortmanna, Isoetes tuckermani, Utricularia purpurea, Gloetrichia, Anabaena, Nostoc, Substrates, Sands, Mud.

Acetylene-reduction assays September-October 1975 indicated that blue-green algae on macrophytes and unvegetated benthic substrates in the littoral of oligotrophic Mirror Lake in New Hampshire's White Mountains region are a significant source of nitrogen in the lake. However, fixation rates were too low to contribute much toward the annual nitrogen requirements of the macrophytes. The cyanophytes fixed nitrogen at 0.1-1.0 micrograms N/g macrophyte dry wt/hr, and 0.5-400 micrograms N/sq m of littoral lake bottom/hr. Divers collected whole rosettes of Lobelia dortmanna and Isoetes tuckermani, six-node apical portions of Utricularia purpurea, and samples of soft substrates. Plants were rinsed and assayed for nitrogenase activity by acetylene-reduction, and nitrogen fixation was calculated according to the ratio of three moles ethylene produced per mole of nitrogen fixed. Colonies of the heterocyst-bearing cyanophyte Gloeotrichia were always present on leaves of Isoetes and Lobelia, which typically support few epiphytes; high variability of nitrogen fixation between Lobelia colonies appeared to correlate with visual estimates of Gloeotrichia density. Of total nitrogen-fixing activity from Lobelia and Utricularia samples, 61-88% was removed by wiping the leaves. Substrate assay results varied greatly among sites, with highest rates associated with massive occurrence of heterocyst-bearing cyanophytes, notably Anabaena and Nostoc. (Lynch-Wisconsin)
W79-04776

THE ECOLOGICAL HISTORY OF A MEDIAEVAL MAN-MADE LAKE, HICKLING BROAD, NORFOLK, UNITED KINGDOM,
University of East Anglia, Norwich (England). School of Environmental Sciences.
B. Moss.
Hydrobiologia, Vol. 60, No. 1, p 23-32, 1978. 6 fig, 34 ref.

Descriptors: *Artificial lakes, *Hickling Broad(United Kingdom), *History, *Paleolimnology, *Paleoecology, *Sedimentation rates, *Eutrophication, United Kingdom, Norfolk Broads(United Kingdom), Lakes, Peat, Sediments, Cores, Agriculture, Guano, Epiphytes, Diatoms, Phytoplankton, Algae, Macrophytes, Turbidity, Black-headed gulls, Larus ridibundus, Birds, Alkalinity, Saline lakes, Radioactive dating, Lead, Fishkill.

The ecological history of Hickling Broad, a lake created in the 14th or 15th century by flooding of alkaline peat diggings in the Norfolk area, United Kingdom, was traced through lead-210 dating of a sediment core, historical information, and recent limnological studies, from an early static period to its current hypereutrophic state. Three phases are distinguished: (1) About 1400 to 1930s--little major change, very low sedimentation rates (0.028 cm/yr), sparse diatom remains (none planktonic), low planktonic populations, and dominance of macrophytes by Chara spp, with some Najas marina; the basin contained a greater extent of undrained marshes and fens which reduced nutrient load to the lake. (2) 1930s to mid or late 1960s--increased basin drainage and use of land for agriculture with considerable fertilization led to much higher organic and inorganic sedimentation rates (0.25 cm/yr), abundant growth of submerged macrophytes, and steady increase of epiphytic diatoms. (3) Mid 1960s to present--hypereutrophication, attributable mainly to droppings from a greatly increased roost of migratory black-headed gulls (Larus ridibundus) on the lake in autumn and winter, reaching about 250,000 in 1976; the sedimentation rate rose to 0.5 cm/yr, epiphytic diatoms increased markedly, and in the early 1970s the previously clear waters became turbid with phytoplankton and the once-luxuriant macrophytes became sparse, now dominated by Potamogeton pectinatus. Hickling Broad is a National Nature Preserve. (Lynch-Wisconsin)
W79-04777

MORPHOLOGICAL VARIATION AND LIFE HISTORY IN CYLINDRICAL FORMS OF SCYTOSIPHON LOMENTARIA (SCYTOSIPHONACEAE: PHAEOPHYTA) FROM SOUTHERN AUSTRALIA,
Monash Univ., Clayton (Australia). Dept. of Botany.
M. N. Clayton.
Marine Biology, Vol. 47, No. 4, p 349-357, 1978. 7 fig, 3 tab, 21 ref.

Descriptors: *Phaeophyta, *Scytosiphon lomentaria, *Life history studies, *Plant morphology, *Reproduction, *Thalli, *Pleomorphism, Growth stages, Plant growth, Algae, Australia, Scytosiphonaceae, Cylindrical form, Sporangia, Microthalli, Sexual reproduction, Asexual reproduction, Zoospores, Seasonal, Habitats, Plurilocular sporangia, Unilocular sporangia.

Investigation of the south Australian polymorphic phaeophyte alga, Scytosiphon lomentaria, and of its cylindrical form showed that morphological variation among natural populations is of a continuous nature, and the species cannot on the basis of morphology be readily segregated into distinct subspecific taxa. S. lomentaria includes within its life history at least three broadly distinct kinds of thallus: (1) cylindrical, (2) complanate, and (3) a prostrate, encrusting form. Considerable morphological plasticity is shown by each form, at least partly due to environmental factors. The cylindrical form was sampled at different times of the year in a variety of habitats in the temperate southeastern region of Australia to assess morphological diversity, and for studies of reproduction and life history wild plants were collected and cultured. Zoospores derived from plurilocular sporangia developed asexually into cylindrical thalli under long and short days at 16 C. The progeny of some cylindrical thalli included microthalli bearing plurilocular or unilocular sporangia; cylindrical forms were obtained in culture from wild microthalli of two kinds--bearing either plurilocular or unilocular sporangia. The microthalli differ morphologically from the ralfsioid stages commonly known to be plethysmothalli and sporophytes of S. lomentaria, but closely resemble microthalli derived from cultures of wild S. lomentaria. (Lynch-Wisconsin)
W79-04778

UV-INDUCED DEVELOPMENTAL ABNORMALITIES IN THE FILAMENTOUS BLUE-GREEN ALGA NOSTOC LINCKIA,
Banaras Hindu Univ. (India). Dept. of Botany.
D. N. Tiwari.
Biochemie und Physiologie der Pflanzen, Vol. 172, No. 5, p 537-540, 1978. 2 fig, 11 ref.

Descriptors: *Nostoc linckia, *Mutation, *Plant growth, *Ultraviolet radiation, *Cytological studies, *Spores, Cell division, Cyanophyta, Reproduction, Filamentous algae, Germinating spores, Resting spores, Plant physiology, Ammonium, Nitrogen, Germlings, Plant morphology, Cell cycle, Life history studies, Clones.

The formation and fate of a mutant clone of the unbranched filamentous cyanophyte alga Nostoc linckia, taken from a colony of N. linckia irradiated with ultraviolet radiation, was traced in detail. Many of the abnormally large, spheroidal cells formed spores which germinated upon return to growth-conducive conditions, generating different types of germlings from the abnormals, and which in some cases proved lethal. the possibility of a transient polyenergidic and/or heterozygous state of these giant cells is discussed. In the original experiments, germinating spores of N. linckia showed higher resistance to UV irradiation than resting spores, with maximal resistance attained more rapidly in the presence of ammonium nitrogen. With further growth, UV-irradiated germinating spores formed colonies of the giant cells under nonphotoreactivating conditions. The clone selected (M-5) showed nearly an 80-85% population of giant cells. Up to 63% of germinating spores showed higher resistance to UV-irradiation on ammonium agar, and 19% on minimal nitrogen agar with a 12-min dose, which was lethal to resting spores. At high doses there was a preponderance of colonies with giant cells 20-25 times as voluminous as normal cells, presumably resulting from a block or delay in septum formation. Concomitant differentiation of 2-5 vegetative cells into heterocysts was also a common feature. Clones raised from abnormal colonies usually showed gradual disappearance of the giant cells, except for M-5 in which the giant cells persisted through several serial transfers. (Lynch-Wisconsin)
W79-04779

SYNCHRONIZED CULTURE OF THE HALOTOLERANT UNICELLULAR GREEN ALGA DUNALIELLA PARVA,
Wuerzburg Univ. (Germany, F.R.). Botanishches Inst. II.
M. Bruggemann, C. Weiger, and H. Gimmler.
Biochemie und Physiologie der Pflanzen, Vol. 172, No. 5, p 487-506, 1978. 10 fig, 3 tab, 56 ref.

Descriptors: *Dunaliella parva, *Photosynthesis, *Synchronization, *Photoperiodism, *Plant physiology, *Osmoregulation, *Cytological studies, *D. viridis, Halotolerance, Salinity, Plant growth, Chlorophyll, Proteins, Energy conversion, Cultures, Chlorophyta, Algae, Unicellular algae, Testing procedures, Methodology, Laboratory tests, Metabolism, Respiration, Biochemistry, Growth rates, Cell cycle, Beneficial use, Biorhythms, Electron transport system.

The cell cycle of the halotolerant unicellular chlorophyte alga Dunaliella parva (also known as D. viridis) was successfully synchronized with a light-dark regime of 14:10 hrs at 30C, pH 7.6, and a concentration of one million cells/ml in an inorganic medium. Cytological and physiological growth characteristics of the cell cycle of D. parva were investigated, with emphasis on photosynthesis and osmoregulation. D. parva, with high growth rate, is easy to culture, lacks a rigid cell wall, is a source of carotinoids, protein, and glycerol, and is a good converter of solar energy into usable chemical energy. Synchronization of the cell cycle significantly improves data reproductivity. Protein/ml algal suspension increased linearly during the light period, and at a reduced rate during the dark period indicating carbohydrate conversion into protein. Photosynthetic carbon dioxide assimilation activity (based on chlorophyll content) was highest in the sixth hour of the light period. Maximal CO2-fixation rates were 2-3 times higher than with nonsynchronous D. parva. Total chlorophyll and carotinoids increased exponentially during the light period. Changes in photosynthetic CO2 assimilation during the cell cycle are assumed caused by changes of the photosynthetic electron transport system. Both photosystems may develop parallel to one another in all synchronized algae, but the use cells make of system I may differ depending on external factors which influence the balance between the photosynthetic electron transport systems. (Lynch-Wisconsin)
W79-04780

FEEDING OF MARINE PLANKTONIC COPEPODS IN MIXED PHYTOPLANKTON,
Skidaway Inst. of Oceanography, Savannah, GA.
G. A. Paffenhofer, and S. C. Knowles.
Marine Biology, Vol. 48, No. 2, p 143-152, 1978. 4 fig, 7 tab, 21 ref. NSF OCE76-01142.

Descriptors: *Copepods, *Zooplankton, *Grazing, *Phytoplankton, *Eucalanus pileatus, *Temora stylifera, *Temora turbinata, Particle size, Food habits, Feeding rates, Marine algae, Algae, Skeletonema costatum, Leptocylindrus danicus, Rhizosolenia alata f. indica, Carbon, Nauplii, Copepodids, Growth stages, Adults, Diatoms, Chrysophyta, Southeast U.S., Continental shelf, Oceans, Atlantic Ocean, Marine biology, Food chains.

Food-size preferences of nauplii, copepodids, and adults of the marine calanoid copepods Eucalanus pileatus, Temora stylifera, and T. turbinata, common to the southeastern U.S. continental shelf, were studied, using three dominant diatom species as food. Diatoms were: (1) Skeletonema costatum (ave cell diam 4.5 micrometers, cell vol 60 cu micrometers); (2) Leptocylindrus danicus (diam 15 micrometers, vol 8000 cu micrometers); and (3) Rhizosolenia alata f. indica (diam 23 and 68 micrometers, vol 100,000 and 1.1 million cu micrometers). E. pileatus nauplii, copepodids, and adult females ingested relatively equal percentages of the three algal species in terms of carbon. Temora juveniles younger than copepodid II ingested mainly the smaller S. costatum; at older stages feeding on the larger L. danicus and R. alata f. indica increased with increasing body wt, while ingestion of S. costatum remained constant. Feeding on high concentrations of large particles reduced grazing pressure on small particles, thus favoring zooplankton with small food-size requirements. Ability of the Temora nauplii to ingest L. danicus may be limited by mandible strength to break the cells, since they are known to feed on 19 x 23-micrometer Periodinium trochoideum. Feeding on E. pileatus on 68-micrometer R. alata f. indica did not start until nauplii IV-V, when body length reached 420-520 micrometers. Potential food range for Temora nauplii is 4-20 micrometers, while for E. pileatus it is 4.5 to over 100 micrometers. (Lynch-Wisconsin)
W79-04781

RESEARCH ON ASCORBIC ACID PHYSIOLOGY IN RED ALGAE. IV. ON THE SEASONAL VARIATION OF AA/DHA RATIO IN PTEROCLADIA CAPILLACEA (GMEL.) BORN. ET THUR. (RHODOPHYTA, GELIDIALES).
Bari Univ. (Italy). Inst. of Botany.
R. Liso, G. Calabrese, and M. Chieppa.
Phycologia, Vol. 17, No. 2, p 143-147, June 1978. 2 fig, 1 tab, 17 ref.

Descriptors: *Rhodophyta, *Pterocladia capillacea, *Ascorbic acid, *Dehydroascorbic acid, *Seasonal, *Plant growth, *Plant physiology, Algae, Growth rates, Vitamins, Oxidation-reduction potential, Grotta Regina(Italy), Italy, Seas, Adriatic Sea, Gelidiales, Fronds, Thalli, Metabolism.

In studies of the red alga Pterocladia capillacea major variations of the ascorbic acid/dehydroascorbic acid (AA/DHA) ratio were found in apical portions of erect fronds; the ratio reached about 16 in December, decreased in spring to about six and remained generally low in summer. AA and DHA curves were inversely related, with much greater variation in AA relative to DHA, and with much higher levels of AA than DHA. Statistical analysis showed the cyclic trend to be highly significant. In the basal portion of the thallus the AA/DHA ratio was very low (about two) throughout the year. P. capillacea was collected in Grotta Regina on the Adriatic coast at Bari, Italy monthly October 1974 to September 1976. The AA and DHA system is important in regulating cell metabolism due to the molecule's ability to undergo oxidation-reduction processes, and the AA/DHA ratio is closely and positively related to red algal growth, as it is in higher plants. Elongation of the main axis and later branches of the erect frond of P. capillacea is linear throughout the year, while considerable seasonal variation is found in diameter. The frond's apical portions are thinner (< one mm) in spring and summer, then flatten out and increase in breadth, reaching a maximum thickness of 2-3 mm in winter due to continued division of the cortical cells (the apical cells of the lateral branches of limited growth). (Lynch-Wisconsin)
W79-04782

OCCURRENCE OF ENDOPHYTIC BACTERIA IN SIPHONOUS ALGAE,
Padua Univ. (Italy). Ist. di Botanica e Fisiologia Vegetale.
P. M. Colombo.
Phycologia, Vol. 17, No. 2, p 148-151, June 1978. 9 fig, 5 ref.

Descriptors: *Bacteria, *Endophytes, *Siphonous algae, *Halimeda tuna, *Udotea petiolata, Seas, Italy, Siphons, Algae, Symbiosis, Electron microscopy, Tyrrhenian Sea, Adriatic Sea, Thalli, Vacuoles, Chloroplasts, Depth.

A brief account is given of the occurrence of endophytic bacteria in the thalli of the siphonous algae Udotea petiolata and Halimeda tuna, between the siphons and within coenocytic filaments. The bacteria were usually located in the vacuole, and preferentially very near the chloroplasts. The bacteria cause no alteration or damage to the structure of the algae, and were observed to divide, suggesting a possible physiological equilibrium between the organisms. The location of the bacteria near the chloroplasts and generally in the younger zones of the thallus might indicate a link with algal photosynthesis and their probable oxygen-dependence, but no firm evidence of symbiosis can be presented as yet. Udotea was collected at sea depths of 0.5, 2.0, 4.0, and 6.0 m at Capo Carbonara (Sardinia, Italy), and Halimeda at sea depths of 0.5 and 6.0 m at Porto Cesareo (Lecce, Italy). Both were fixed under water and studied with electron microscopy. The endophytic bacteria, quite similar in the two plant species, were characterized by a thick cell envelope and by cytoplasm with a central nucleoid in which DNA-like microfibrils were often visible, and were 0.3-0.5 micrometers in diameter and 1.5-2.0 micrometers long. Bacteria with an external fibrillar sheath were observed on a Udotea plant. The number of endophytes seems to decline with increasing depth. (Lynch-Wisconsin)
W79-04783

THE SPRING PHYTOPLANKTON BLOOM IN LINDASPOLLENE, A LANDLOCKED NORWEGIAN FJORD. II. BIOMASS AND ACTIVITY OF NET-AND NANOPLANKTON,
Bergen Univ. (Norway). Inst. of Marine Biology.
H. R. Skjoldal, and C. Lannergren.
Marine Biology, Vol. 47, No. 4, p 313-323, 1978. 6 fig, 4 tab, 49 ref.

Descriptors: *Lindaspollene(Norway), *Fjords, *Net plankton, *Nannoplankton, *Biomass, *Eutrophication, *Algae, Zooplankton, Copepods, Norway, Adenosine triphosphate, Chlorophyll, Phaeophytin, Carbon radioisotopes, Respiration, Carbon, Nutrients, Silicates, Benthos, Skeletonema costatum, Diatoms, Chrysophyta, Depth, Oxygen.

Relative contributions of net (less than 30 micrometers) and nannoplankton to total biomass, carbon assimilation, and oxygen utilization were determined for Lindaspollene, a landlocked fjord on Norway's Atlantic coast during the spring phytoplankton bloom February-April 1975. Biomass was measured in terms of chlorophyll-a and adenosine triphosphate (ATP), and oxygen utilization as electron transport system (ETS) activity. Net plankton averaged 48% of total chlorophyll-a and 56% of the ATP, but contributed only 7% to total carbon assimilation and 11% to ETS activity. Assimilation values (mg C assimilated/mg chl-a/hr) were 0-1.2 for net plankton and 1.5-13.2 for nannoplankton.

High concentrations of ATP (but not chlorophyll-a) were found in the nannoplankton fraction at the oxygen/hydrogen sulfide interface. Net planktonic algae grew actively only in the first phase of the bloom, while nannoplankton dominated later, apparently due to low nutrient concentrations. Skeletonema costatum dominated the biomass during the bloom. Number of cells in the chains decreased during the bloom, possible reflecting lowered silicate content. Only nannoplankton appeared to be grazed by zooplankton (dominated by copepods), while net plankton sank to the bottom. The phaeophytin/chlorophyll-a ratio was less than 0.6 during the bloom, increasing after the bloom especially at 30-50 m probably because of debris sinking from the bloom. (Lynch-Wisconsin)
W79-04784

NEW RECORDS OF MARINE ALGAE FROM CHILE AND THEIR EFFECT ON PHYTOGEOGRAPHY,
Universidad Catolica de Chile, Santiago. Lab. de Zoologia.
B. Santelices, and I. A. Abbott.
Phycologia, Vol. 17, No. 2, p 213-222, June 1978. 2 fig, 2 tab, 74 ref.

Descriptors: *Phytogeography, *Chile, *Marine algae, *Chlorophyta, *Phaeophyta, *Rhodophyta, *Distribution, *Classification, Algae, South America, Temperate, Tropical regions, Cold regions, Geographical regions, Peru, Classification, Floral lists, Coasts, Oceans, Pacific Ocean.

Of 40 species of marine algae newly reported from central and northern Chile, 17 are new to Pacific South America, and the rest are range extensions from Peru and within Chile. Twenty-one Rhodophyta, 10 Chlorophyta, and nine Phaeophyta are included. Twenty-one taxa are primarily temperature plants and represent a group of biopolar species, seven are tropical, and six are subantarctic. The mix of species reflects the long Chilean coastline, the great topographical variation of which affects ecology and distribution. About half the species were collected near Valparaiso. Rhodophyta include Porphyropsis coccinea, Acrochaetium amphiroae, A. polysporum, Asparagopsis armata, Gelidium congestum, Pterocladia caloglossoides, Schimmelmannia plumosa, Trematocarpus dichotomus, Montemaria horridula, Rhodymenia hancockii, Dendrymenia skottsbergii, Ballia callitrichia, Ceramium stichidiosum, Tiffaniella snyderiae, Anisocladella pacifica, Branchioglossum brattstroemii, Polysiphonia scopulorum var. villu, Herposiphonia ceratoclada, H. sulivaniae, Bostrychia rivularis, and B. scorpioides; Chlorophyta include Chaetomorpha firma, C. melagonium, Ulva costata, U. taeniata, Rama novae-zelandiae, Clodophoropsis herpestica, Bryopsis peruviana, B. rhizophora, Derbesia marina, and Codium dimorphum; and Phaeophyta include Giffordia granulosa, Spongoneam tomentosum, Ralfsia pacifica, Haloperis hordacea, Hapalospongidion gelatinosum, Haplogloia andersonii, Colpomenia tuberculata, Endarachne binghamiae, and Adenocystis utricularis. (Lynch-Wisconsin)
W79-04785

THE GROWTH AND DEATH OF THE MACROCYSTIS SPOROPHYTE (PHAEOPHYCEAE, LAMINARIALES),
New Brunswick Univ., St. John. Div. of Sciences.
C. S. Lobban.
Phycologia, Vol. 17, No. 2, p 196-212, June 1978. 14 fig, 2 tab, 82 ref.

Descriptors: *Plant physiology, *Plant morphology, *Phaeophyta, *Plant growth, *Macrocystis pyrifera, *Macrocystis angustifolia, *Macrocystis integrifolia, *Growth stages, Growth rates, Reviews, Metagenesis, Sporophytes, Nutation, Holdfasts, Sessile algae, Algae, Haptera, Death, Life history studies, Life cycles, Senescence, Fronds, Life span, Canopies, Sporophylls, Laminariales.

Previous research on the phaeophyte algal genus Macrocystis is reviewed to develop a composite description of the plant's development, emphasizing growth and death of the Macrocystis sporophyte. Anatomical and physiological development is examined from the undivided lamina stage until death. Of three species currently recognized, most literature refers to economically important M. pyrifera, no published physiological data exists on M. angustifolia, and the author's research has centered on M. integrifolia. Spiral and alternate blade arrangements are both the results of spontaneous movement during growth; blades are initiated in one plane. Sporphylls can be viewed as modified fronds. Haptera are negatively phototropic, and thigmotropism seems to stop their growth. Growth curves are used to define juvenile, mature, and senile phases. Growth of fronds, and perhaps of sporophylls, is indeterminate, but growth of laminae is determinate. Plants live 4-8 years, fronds normally about six months. Canopy structure and blade arrangement can be compared to forest canopies. Macrocystis does not readily recruit, and M. integrifolia in particular relies more on vegetative propagation than on sexual reproduction to maintain itself. Plant growth is both environmentally and internally regulated. Known algal hormones are briefly reviewed, and possible hormore action in Macrocystis is discussed. Fertility may be controlled by substances left by the apical meristem in laminae which are to remain sterile. (Lynch-Wisconsin)
W79-04786

PATHWAY AND PRODUCTS OF CO2-FIXATION BY GREEN PROKARYOTIC ALGAE IN THE CLOACAL CAVITY OF DIPLOSOMA VIRENS,
Nagoya Univ. (Japan). Research Inst. for Biochemical Regulation.
T. Akazava, E. H. Newcomb, and C. B. Osmond.
Marine Biology, Vol. 47, No. 4, p 325-330, 1978. 4 fig, 1 tab, 22 ref. NSF-GB 36173, GA 34948, GD 34462.

Descriptors: *Diplosoma virens, *Chlorophyta, *Photosynthesis, *Prokaryotic algae, *Carbon dioxide, Ascidiacea, Tunicata, Algae, Cloacal cavity, Chloropyll, Enzymes, Photosynthetic products, Metabolism, Australia, Great Barrier Reef(Australia), Lissoclinum punctatum, Polymers, Carbon radioisotopes, Pathways, Pigments, Biochemistry, Oligosaccharides, Sucrose, Sugars.

Experiments with the bright-green, unicellular, prokaryotic, chlorophyte algae living in the cloacal cavity of the didemnid ascidian (sea squirt) Diplosoma virens, collected in 1973 and 1976 from two sites on Australia's Great Barrier Reef, show that: (1) photosynthetic carbon dioxide assimilation by these unusual algae evidently proceeds via the initial carboxylation of ribulose-1,5-biphosphate; (2) the principle end-product of carbon fixation is a water-soluble oligosaccharide (an alpha-1,4-glucan); and (3) photosynthetic products are not rapidly incorporated into the structural material of the animal host. Light-dependent carbon-14 carbon dioxide fixation ranged 3-27 micromoles/mg chlorophyll/hr. A maximum of 7% of the carbon-14 fixed was found in insoluble materials of the algae or its host after one hr of carbon-14 carbon dioxide fixation. Whether the alpha-1,4-glucan is a product of algal or animal metabolism remains to be determined. The algae probably fix carbon dioxide by the conventional C3 carbon-reduction pathway, but differ from higher plants and other chlorophytes in which sucrose is the major photosynthetic end-product. These algae, also found in ascidians from Bja California, Mexico, have attracted attention because, although prokaryotic, contain the complement of chlorophyll pigments thought to exist only in eukaryotic cells. Neither phycobilosomes nor bilin pigments have been detected. (Lynch-Wisconsin)
W79-04787

THE EFFECTS OF AMMONIUM IN WATER ON POTAMOGETON LUCENS,
Tel-Aviv Univ. (Israel). Dept. of Botany.
M. Litav, and Y. Lehrer.
Aquatic Botany, Vol. 5, p 127-128, 1978. 6 tab, 24 ref.

Descriptors: *Aquatic plants, *Toxicity, *Detergents, *Ammonium salts, *Mortality, *Primary productivity, Water pollution effects, Water pollution sources, Ammonium, Nitrogen compounds, Rooted aquatic plants, Hydrogen ion concentration, Laboratory tests, Acidity, Water properties, *Potamogeton, *DBS.

Rooted Potamogeton lucens plants were heavily damaged by NH4+ concentrations of 40 ppm nitrogen, while detached branches were damaged by ammonium concentrations of 10-15 ppm nitrogen. Bubbling of CO2 gas through the water reduced its pH from 8.5 to about 6.0 and this prevented the appearance of ammonium-induced injury symptoms. This effect was explained by the fact that the ionic form of ammonia is much slower to penetrate into cells than the molecular form. Dodecylbenzenesulfonate, when applied to the water in conjunction with an ammonium salt, produced rapid death of the plants. This was probably due to the much increased rate of ammonia uptake, caused by the effect of the detergent on the cell membranes. (Katz-EIS)
W79-04815

ENTRAINMENT OF LARVAL FISH BY THE DOUGLAS POINT GENERATING STATION, LAKE HURON, IN RELATION TO SEASONAL SUCCESSION AND DISTRIBUTION,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. R. M. Kelso, and J. K. Leslie.
Journal of the Fisheries Research Board of Canada, Vol. 31, No. 1, p 37-41, 1979. 3 fig, 2 tab, 4 ref.

Descriptors: *Lake Huron, *Nuclear power plants, *Nuclear reactors, Freshwater fish, Larval growth stage, *Juvenile fish, Larval fish, Suckers, Yellow perch, Smelt, Alewife, Sculpin, Entrainment, Cooling water, Douglas Point Generating Station.

Larval fish were sampled by net in Lake Huron and the Douglas Point generating station throughout spring, summer, and early fall 1975. Dominance shifted from fourhorn sculpin to rainbow smelt then to alewife from late April to late September. Entrainment of the major species paralleled dominance and abundance observed in the lake, but yellow perch, brook stickleback, and slimy sculpin caught in the lake - each ranging from 5 to 25% of the total catch - were not entrained. Conversely, white sucker was entrained but not captured in the lake. Size of individuals entrained, upper limit approx. 40 mm, paralleled size of individuals in the lake. Vertical distribution, and thus proximity to the submerged intake, greatly influenced entrainment rate. (Katz-EIS)
W79-04816

AMMONIA TOXICITY AND PH CONTROL IN FISH TOXICITY BIOASSAYS OF TREATED WASTEWATERS,
Los Angeles County Sanitation Districts, Whittier, CA. San Jose Creek Water Quality Lab.
R. Baird, J. Bottomley, and H. Taitz
Water Research, Vol. 13, p 181-184, 1979. 3 fig, 1 tab, 4 ref.

Descriptors: *Ammonia, *Toxicity, *Bioassay, *Shiners, Hydrogen ion concentration, Fish kills, Carbon dioxide, Waste water(Pollution), Activated sludge, Water chemistry, Mortality, Dissolved oxygen, Nitrogen, Sewage effluents, Methodology, Los Angeles County.

A means of preventing anomalous fish kills in static bioassay testing of ammonia-containing treated wastewaters is described. Low flow O2 is used instead of air in order to prevent O2 stripping, subsequent pH rise and increases in the NH3 levels during the course of the test. (Deal-EIS)
W79-04817

LAKE NEMATODE POPULATION INCREASE FOLLOWING BYPASS OF SECONDARY EFFLUENT,

Cornell Univ. Ithaca, NY. Dept. of Natural Resources.
S. B. Smith.
Journal of the Water Pollution Control Federation, Vol. 51, No. 2, p 406-410, 1979. 1 fig, 2 tab, 9 ref.

Descriptors: Eutrophication, Secondary treatment, Sewage treatment, Benthic fauna, Waste water treatment, Phosphorus, Animal populations, Growth rates, Enteric bacteria, Public health, Ammonia, Chlorine, Pathogenic bacteria, Viruses, New York Canandarago Lake, Richfield Springs, *Nematodes, *Tertiary treatment.

Benthic investigations from Canadarago Lake indicate a definite increase in the nematode population following the initiation of the tertiary treatment process at the plant in Richfield Springs, New York. The benthic nematode increase appears because of the abundance of the nematodes in the aeration lagoons involved with the secondary effluent at the treatment plant, where a build up of small animals (such as rotifers and ciliates) and algae are likely to occur. Periods of bypass from the aeration lagoons to the chlorine contact chamber, in particular, showed evidence of increased nematode populations in the lake benthos. (Deal-EIS)
W79-04818

LEAD ACCUMULATION IN PLANKTON BLOOMS FROM ULLSWATER, THE ENGLISH LAKE DISTRICT,
London Univ. (England). Dept. of Botany; and London Univ. (England). Dept. of Biochemistry.
P. Denny, and R. P. Welsh.
Environmental Pollution, Vol. 18, p 1-9, 1979. 3 tab, 15 ref.

Descriptors: *Lead, *Plankton, *Eutrophication, Heavy metals, Water chemistry, Lakes, Phytoplankton, Zooplankton, Metabolism, Algae, Food chains, Chemical analysis, Path of pollutants, Spectrophotometry, Food webs, *Bioaccumulation, *Bioconcentration.

Concentrations of lead in plankton samples from Ullswater were compared with concentrations in samples from Bassenthwaite Lake and Mockerkin Tarn. Melosira and Asterionella blooms from Ullswater contained up to 772 micrograms Pbg-1, organic dry weight, whilst samples from the other lakes contained 29-167 micrograms Pbg-1. The Ullswater phytoplankton represented a lead concentration factor in excess of 100,000 and possible mechanisms for this are suggested. It was estimated that these algal blooms contributed 1-2 mg Pbm-2 to the sediment. Data from the zooplankton indicated that lead from phytoplankton may have been transferred and accumulated into the zooplankton food chain. (Deal-EIS)
W79-04819

ANNUAL CYCLES OF SOME CLADOCERANS IN A POLLUTED STREAM,
Baghdad Univ. (Iraq). Dept. of Biology.
M-B. M. Mohammad.
Environmental Pollution, Vol. 18, p 71-82, 1979. 7 fig, 2 tab, 27 ref.

Descriptors: *Reproduction, *Daphnia, Annual, Animal physiology, Crustaceans, Broods, Seasonal, Biorhythms, Statistical analysis, Biochemical oxygen demand, Water pollution effects, Domestic wastes, Tubificids, Sewage, *Monia, *Arthropods, Baghdad, Khir River, Iraq.

The purpose is to investigate the effects of pollution on cyclic reproduction of several cladocerans in an extremely sluggish, polluted, streams (Khir River) in Baghdad, the Republic of Iraq. Daphnia magna and Moina brachiata have one sexual phase during the year, while Ceriodaphnia riguadi has two. Simocephalus exspinosus exhibits one or two sexual phases, depending on the amount of pollution in the habitat. Brood-size of the last-named cladocern tends to increase with increase in organic enrichment up to a certain level. Alona costata, Pleuroxus denticulatus, and Chydorus sphaericus propagate in the stream but never in sufficient numbers for reliable determinations of cyclic reproduction. (Deal-EIS)
W79-04820

CYCLOMORPHOSIS IN DAPHNIA CARINATA KING (CRUSTACEA: CLADOCERA) FROM TWO ADJACENT SEWAGE LAGOONS IN SOUTH AUSTRALIA,
Adelaide Univ. (Australia). Dept. of Zoology.
B. D. Mitchell.
Australian Journal of Marine and Freshwater Research, Vol. 29, p 565-576, 1978. 6 fig, 1 tab, 33 ref.

Descriptors: *Seasonal, *Crustaceans, *Sewage lagoons, *Daphnia, Size, Animal physiology, Animal metabolism, Growth stages, Water temperature, Genetics, Adaptation, Biochemistry, Animal populations, Waste treatment, *Cyclomorphosis, *Morphology.

Seasonal changes in morphology are described for D. carinata from two adjacent sewage lagoons in South Australia. Carapace width to body length ratios of a variety of developmental stages showed carapace expansion in adults larger than 2mm during times of the year when water temperature was decreasing. Carapace expansion was primarily dorsal in aspect. Several forms occurred concurrently during periods of morphological change. Cyclomorphosis in D. carinata is discussed in relation to studies on Holarctic Daphnia. (Deal-EIS)
W79-04821

ACCUMULATION OF HEAVY METALS BY THE MARINE DIATOM DITYLUM BRIGHTWELLII (WEST) GRUNOW,
Melbourne Univ., Parkville (Australia). School of Botany.
G. S. Canterford, A. S. Buchanan, and S. C. Ducker.
Australian Journal of Marine and Freshwater Research, Vol. 29, p 613-622, 1978. 6 fig, 3 tab, 31 ref.

Descriptors: *Heavy metals, *Diatoms, *Absorption, *Copper, *Zinc, *Cadmium, *Lead, Plankton, Water chemistry, Chemical analysis, Path of pollutants, Spectrophotometry, Growth rates, *Bioaccumulation, *Bioconcentration.

The accumulation of copper, zinc, cadmium, and lead by the marine planktonic diatom D. brightwellii cultured under laboratory conditions is described. With the exception of copper, the concentration of metal taken up by D. brightwellii generally increased with increasing concentration of the metal in the medium. From calculated biological concentration factors (BCF), metal uptake was in the order Zn>PB>Cu>Cd. For each metal, the BCF value and percentage uptake generally decreased with increasing metal concentration in the medium. (Deal-EIS)
W79-04822

EFFECTS OF TEMPERATURE AND SALINITY ON THE LIFE CYCLE OF OPHRYOTROCHA DIADEMA (POLYCHAETA, DORVILLEIDAE),
Goteborg Univ. (Sweden). Dept. of Zoology.
B. Akesson, and J. D. Costlow.
Ophelia, Vol. 17, No. 2, p 215-229, 1978. 6 fig, 10 tab, 13 ref.

Descriptors: *Salinity, *Water temperature, *Toxicity, Reproduction, Growth stages, Larval growth stage, Mortality, Fertility, Life cycles, Life history studies, Growth rates, Animal physiology, *Polychaetes.

Experiments were performed in 5% steps of salinity from 15 to 45% combined with temperatures of 15, 18, 21 and 25C. At salinities of 15 and 20% all animals, both adults and larvae, died within two days. In the remaining 20 salinity/temperature combinations adults were kept for 3 weeks and larvae for a minimum of one month or until they were sexually mature. For adults, mortality, number and size of egg masses, and reproductive success were recorded. Corresponding parameters for larvae were mortality, growth rate and time to beginning of reproduction. Optimum conditions for survival were obtained at 35% salinity and 18C. The optimum for egg production (reproductive rate) was 35% and 25C. The maximum growth rate was observed at 30 and 35% salinity and 25C. These two combinations also represented the shortest time of development to sexual maturity. The number of eggs per egg mass was significantly salinity dependent, with an optimum at 35%, but was not affected by temperature, except at 40% salinity, or by salinity/temperature interaction. (Deal-EIS)
W79-04823

PARALYTIC SHELLFISH TOXINS IN THE SEA SCALLOP, PLACOPECTEN MAGELLANICUS, IN THE BAY OF FUNDY,
Rhode Island Univ., Kingston. Coll. of Pharmacy.
For primary bibliographic entry see Field 5A.
W79-04825

STUDIES ON TOXIC EFFECTS OF PESTICIDES ON FISH - II TOXIC EFFECTS OF THE HERBICIDE, BENTHIOCARB, ON CARP. (IN JAPANESE),
Mie Prefectural Univ., Tsu (Japan). Faculty of Fisheries.
T. Ochiai, and S. S. Kubota.
Bulletin of the Faculty of Fisheries, Mie University, No. 5, p. 155-163, 1978. 1 fig, 2 tab, 7 ref. (English abstract).

Descriptors: *Fish disease, *Animal pathology, *Herbicides, *Toxicity, *Mortality, Water pollution effects, Fish physiology, Bioassay, Lethal limit, Carp, Water pollution effects, Pesticides, Toxins, *Benthiocarb, *Histology, Hematology, Hemorrhage, Hemoglobin.

The toxic effects of the herbicide, benthiocarb, on carp were investigated. All the carp died within 14 days after continuous exposure to benthiocarb at 3.2 and 1.8 ppm, but 75% of the carp survived at 1.0 ppm for 21 days. Anemia was found in the carp exposed to benthiocarb at 1.8 and 1.0 ppm. It was expressed as a decrease of the red blood cell count, hemoglobin volume, and hematocrit value. The long axis of mature erythrocytes in the anemic carp tended to be shorter. In the anemic carp, hemosiderin deposit intensively increased in the spleen and the head kidney. In both anemic and non-anemic carp exposed to 1.8, 1.0 and 0.56 ppm, spherical bodies were extensively observed throughout the liver. The walls of these bodies could be stained with pyronin, but several methods failed to stain their contents. In both anemic and non-anemic carps at 3.2, 1.8 and 1.0 ppm, hemorrhage was seen in the lamina propria of the intestine. Thus, it is considered that the toxic effects of benthiocarb on carp are anemia, degeneration of hepatic cells and hemorrhage in the intestine. (Katz-EIS)
W79-04826

EFFECTS OF SIMAZINE TREATMENT ON CHANNEL CATFISH AND BLUEGILL PRODUCTION IN PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. S. Tucker, and C. E. Boyd.
Aquaculture, Vol. 15, p. 345-352, 1978. 6 fig, 2 tab, 13 ref.

Descriptors: *Channel catfish, *Aquiculture, Productivity, *Dissolved oxygen, *Herbicides, *Farm ponds, *Aquatic weed control, Sunfishes, Commercial fish, Phytoplankton, Bottom sediments, Fish farming, Fish management, Pesticides, Plant growth regulators, Algae, Growth rates, *Simazine, *Ictalurus, *Lepomis, Fish yield.

Application of 13.4 kg/ha of simazine to the bottoms of channel catfish (Ictalurus punctatus) ponds before flooding resulted in an extended period of low dissolved oxygen, a significant reduction of 19% in channel catfish yield, and poorer feed conversion by fish when compared to control ponds. A single application of 1.5 mg/l of simazine to the water of fertilized bluegill (Lepomis macrochirus) ponds also decreased dissolved oxygen.

The 11% reduction in bluegill yield was not statistically significant. Simazine treatment caused an initial reduction in macrophyte coverage in bluegill ponds, but macrophyte coverage increased as simazine concentrations in the pond water declined. (Katz-EIS)
W79-04827

STUDIES ON TOXIC EFFECTS OF PESTICIDES ON FISH-I. TOXIC EFFECTS OF THE HERBICIDE, MOLINATE, ON CARP,
Mie Prefectural Univ., Tsu (Japan). Faculty of Fisheries.
T. Ochiai, and S. S. Kubota.
Bulletin of the Faculty of Fisheries, Mie University, No. 5, p. 129-153, 1978. 3 fig, 11 tab, 25 ref. (English abstract).

Descriptors: *Fish diseases, *Pathology, *Herbicides, *Toxicity, *Mortality, *Mode of action, Water pollution effects, Biochemistry, Fish physiology, Carp, Vitamins, Bioassay, Pesticides, Nutrient requirements, Analytical techniques, *Coagulation factors, *Anemia, *Hemorrhage, *Vitamin K, *Hematology, *Molinate.

The toxic effect of the herbicide, molinate, on carp arises from hemmorhagic anemia resulting from hemorrhages occurring mainly in the gill. No cytological change was observed in the blood of anemic carp except for increased immature erythrocytes. Bleeding time, plasma prothrombin time, and partial thromboplastin time of the exposed carp's blood were prolonged in proportion to the duration of exposure. These facts indicated that a blood coagulation factor of the exposed carp was obstructed. The obstructed coagulation factor was named 'M factor' and resembles the X factor, of human blood. Food containing vitamin K was highly effective in preventing hemorrhagic anemia in the exposed carp. Both vitamin K3 and K4 were suited for this purpose. The toxic effects of molinate on carp were increased if carp were first exposed to 0.8 ppm nifulpyrinol. (Katz-EIS)
W79-04828

SOME EFFECTS OF GAS-SUPERSATURATED SEAWATER ON SPISULA SOLIDISSIMA AND ARGOPECTEN IRRADIANS,
National Marine Fisheries Service, Milford, CT. Experimental Biologial Investigations.
R. Goldberg.
Aquaculture, Vol. 4, p. 281-287, 1978. 2 fig, 2 tab, 10 ref.

Descriptors: *Aquiculture, *Clams, *Commercial shellfish, *Supersaturation, *Oxygen, *Mollusks, Invertebrates, Shellfish, Nitrogen, Mortality, Animal pathology, Diseases, Environmental effects, Lethal limit, Animal behavior, *Scallops, *Spisula, *Argopecten, *Gas supersaturation, *Bivalves, *Gas-bubble disease.

Two size classes of the surf clam, Spisula solidissima, and the bay scallop, Argopecten irradians, were exposed to different concentrations of gas-supersaturated seawater in a flowing seawater system. Both species tested experienced no mortality when held in the control treatment maintained at 96% oxygen and 109% nitrogen. Mortality, gill tissue damage, gas emboli, membranous tissue blisters, and abnormal secretion of shell material were induced experimentally at elevated levels of gas supersaturation. Results indicate significant mortalities of surf clams and scallops held at 114% oxygen and 195% nitrogen, and at higher levels of gas concentration. These values suggest a point of reference for the bivalve culturist in identifying potential problems which can be caused by gas-supersaturated seawater. (Katz-EIS)
W79-04829

AUTOTROPHIC AND HETEROTROPHIC PRODUCTION OF MICROORGANISMS IN INTENSELY-MANURED FISH PONDS, AND RELATED FISH YIELDS,
Agricultural Research Organization, Dor (Israel). Fish and Aquaculture Station.
G. L. Schroeder.
Aquaculture, Vol. 14, p. 303-325, 1978. 2 fig, 7 tab, 40 ref.

Descriptors: *Aquiculture, *Fish food organisms, *Aquatic microorganisms, *Fish diets, *Food chains, *Farm wastes, *Carp, Dissolved oxygen, Respiration, Benthos, Tilapia, Protozoa, Aquatic bacteria, Fertilizers, Organic matter, Growth rates, productivity, Primary productivity, On-site investigation, Water quality, *Nitrogen sources, *Feed conversion ratio.

Intensely-manured ponds produce 15-30 kg fish/ha/day with cow or chicken manure and nitrogen- and phosphate-rich fertilizers as the only nutritional inputs. The manure as it is supplied to the ponds is not a good fish food and does not produce good fish growth. Quantitative analysis shows that the production of all organisms, autotrophic and heterotrophic, pelagic and benthic, large enough to be used directly by the fish (i.e., larger than 37 microns) is adequate to account for less than half of the measured fish growth. Production within the microbial community that flourishes on and rapidly digests the manure organic matter is adequate to produce the measured fish growth. The fish appear to harvest the microorganisms at the level of bacteria and protozoa, by ingesting the small straw-like particles which comprise much of the manure and serve as the substrate for the microbial growth. (Katz-EIS)
W79-04831

THE INFLUENCE OF TEMPERATURE AND WET WEIGHT ON THE OXYGEN DEMAND OF RAINBOW TROUT (SALMO GAIRDNERI R.) IN FRESH WATER,
Electricite de France, Paris, Direction de l'Equipment.
A. Muller-Feuga, J. Petit, and J. J. Sabaut.
Aquaculture, Vol. 14, p 355-363, 1978. 2 tab, 4 fig, 11 ref.

Descriptors: *Rainbow trout, *Bioassay, *Water temperature, *Oxygen demand, *Aquiculture trout, Salmonids, Respiration, Environmental effects, Size, Weight, Metabolism, Mathematical studies, Regression analysis, Fish physiology, Oxygen, Salmo gairdneri, Feeding levels, Activity ratio.

Multiple regression analysis was applied to a series of oxygen demand measurements on rainbow trout. It confirmed the determinant influence of temperature and size of fish under standard feeding conditions. Two types of adjustment of oxygen demand in relation to those two factors were tested, and one of them was choosen in which the temperature is under an exponential form. This allows the introduction of the Q10 concept, an activity ratio. The value of Q10 is 3.5 when the water temperature is below 10C and 1.7 above 12C. (Katz-EIS)c
W79-04832

ACUTE TOXICITY OF COPPER, ZINC AND MANGANESE IN SINGLE AND MIXED SALT SOLUTIONS TO JUVENILE LONGFIN DACE, AGOSIA CHRYSOGASTER,
Arizona State Univ., Tempe. Dept. of Zoology.
M. Lewis.
Journal of Fish Biology, Vol. 13, p 695-700, 1978. 1 fig, 3 tab, 17 ref.

Descriptors: *Toxicity, *Copper, *Zinc, *Manganese, *Mine wastes, Juvenile growth stage, Mortality, Metals, Fish physiology, Heavy metals, Salts, Mine water, Chemical wastes, Freshwater fish, Bioassay, *Agosia, *Longfin Dace.

The acute toxicity of copper, zinc and manganese and copper-zinc and copper-manganese mixtures were determined for juvenile longfin dace in hard water bioassays. Copper-zinc was the most lethal toxicant and exhibited a more than additive toxicity which was in contrast to the additive toxicity of copper-manganese mixtures. The toxicity of copper and zinc to the fish was similar but both were considerably more lethal than manganese. (Deal-EIS)
W79-04833

THE EFFECTS OF SOME POLLUTANTS ON THE SURVIVAL, GROWTH AND RESPIRATION OF LAMINARIA HYPERBOREA,
Liverpool Univ. (England). Dept. of Marine Biology.
R. Hopkins, and J. M. Kain.
Estuarine and Coastal Marine Science, Vol. 7, No. 6, p 531-553, 1978. 12 fig, 5 tab, 46 ref.

Descriptors: *Growth rates, *Respiration, *Phaeophyta, *Toxicity, Water pollution effects, Heavy metals, *Cadmium, *Zinc, *Mercury, *Copper, Organic compounds, Detergents, Pesticides, Herbicides, 2,4-D, Phenols, Growth stages, Cytological studies, *Marine plants, *Survival.

The effects of seventeen pollutants, including metals, herbicides and detergents were measured in the laboratory by culturing the young stages and measuring the respiration rates of discs of mature frond tissue of Laminaria hyperborea. The pollutants tested were: mercury; copper; zinc; cadmium; atrazine; dalapon; MCPA; 2,4-D; phenol; sodium pentachlorophenate; 2 detergent mixtures; sodium lauryl ether sulfate; sodium dodecyl benzene sulfonate; coconut fatty acid diethanolamide; pluronic; and DOBS55. Tests were also conducted using polluted seawater collected from the coast of N.E. England. (Deal-EIS)
W79-04834

CHRONIC EXPOSURE OF CHANNEL CATFISH, ICTALURUS PUNCTATUS, TO AMMONIA: EFFECTS ON GROWTH AND SURVIVAL,
California Univ., Davis. Dept. of Civil Engineering.
J. Colt, and G. Tchobanoglous.
Aquaculture, Vol. 15, p 353-372, 1978. 5 fig, 3 tab, 59 ref.

Descriptors: *Channel catfish, *Ammonia, *Nitrogen compounds, *Growth rates, Nitrogen cycle, Juvenile growth stage, Mortality, Toxicity, Aquiculture, Commercial fish, Lethal limit, Water pollution sources, Water pollution effects, Water quality, Environmental effects, Laboratory tests, Bioassay, *Ictalurus punctatus, *Sublethal effects.

The growth of juvenile channel catfish (Ictalurus punctatus) was reduced in a linear manner during a 31 day growth trial when exposed to concentrations of ammonia ranging from 48 to 989 microgr/l NH3-N (0.31 to 5.71 mg/l NH+4-N). On a wet weight basis, growth was reduced by 50% at 517 microgr/l NH3-N and the no growth occurred at 967 microgr/l. The no growth level was 60% of 96-h LC50 value. Mortality was increased significantly at 989 microgr/l NH3-N and above. The sublethal effects of ammonia may depend, in part, on the concentrations of NH+4 and Na+ in solution. (Katz-EIS)
W79-04835

ZINC CONTENT OF THE GILLS OF RAINBOW TROUT (S. GAIRDNERI) AFTER TREATMENT WITH ZINC SOLUTIONS UNDER NORMOXIC AND HYPOXIC CONDITIONS,
Bristol Univ. (England). Research Unit for Comparative Animal Respiration.
G. M. Hughes, and R. Flos.
Journal of Fish Biology, Vol. 13, p 717-728, 1978. 5 fig, 4 tab, 32 ref.

Descriptors: *Rainbow trout, *Zinc, *Toxicity, Fish physiology, Water chemistry, Chemical analysis, Heavy metals, Path of pollutants, Oxygen, Dissolved oxygen, Absorption, Chemical reactions, Enzymes, *Tissue analysis, *Gills.

Forty specimens of rainbow trout were divided into 4 groups which were treated as follows (a) normoxic clean water; (b) hypoxic clean water; (c) normoxic water with 10 ppm zinc for 10 h; (d) hypoxic water with 10 ppm zinc for 10 h. The zinc content was determined separately for each of the 4 gill arches on each side of the fish. Values for the zinc concentration were greater following the zinc treatments, but no significant difference between hypoxia and normoxia was observed. Differences in concentrations of zinc were found in different

arches whether expressed per gram dry weight or per unit surface area of the secondary lamellae. (Deal-EIS)
W79-04836

TOXIC EFFECTS OF ZINC ON FATHEAD MINNOWS PIMEPHALES PROMELAS IN SOFT WATER,
Environmental Research Lab., Duluth, MN.
D. A. Benoit, and G. W. Holcombe.
Journal of Fish Biology, Vol. 13, p. 701-708, 1978. 3 tab, 24 ref.

Descriptors: *Zinc, *Toxicity, *Minnows, Life cycles, Life history studies, Fish eggs, Growth stages, Spawning, Fish reproduction, Larval growth stage, Resistance, Heavy metals, Bioassay, Fish physiology, Bioassay, Methodology, *Pimephales.

A fathead minnow life-cycle exposure to various zinc concentrations demonstrated that the most sensitive indicators of zinc toxicity were egg adhesiveness and fragility, which were significantly affected at 145 micrograms Zn 1-1 and above, but were not affected at 78 micrograms Zn 1-1 and below. These effects occurred shortly after the eggs were spawned (during water hardening) and therefore were not related to effects on the parental fish. Hatchability and survival of larvae were significantly reduced, and deformities at hatching were significantly increased at 295 micrograms Zn 1-1 and above. Acclimated and unacclimated groups of larvae exposed to identical zinc concentrations for 8 weeks after hatch showed only slight differences in sensitivity. (Deal-EIS)
W79-04837

THE GROWTH AND BIOMASS DISTRIBUTION OF TWO EMERGENT FRESHWATER PLANTS, CYPERUS ESCULENTUS AND SCIRPUS VALIDUS, ON DIFFERENT SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. W. Barko, and R. M. Smart.
Aquatic Botany, Vol. 5, p. 109-117, 1978. 1 fig, 5 tab, 24 ref.

Descriptors: *Growth rates, *Biomass, *Bottom sediments, *Aquatic plants, *Plant growth, *Rooted aquatic plants, Primary productivity, Sediments, Aquatic soils, Laboratory tests, Clays, Coarse sediments, Sand, Nutrients, Particle size, Adsorption, Nitrogen, Phosphorus, *Cyperus, *Scirpus, Emergent plants, Nutrient availability.

The growth of two emergent freshwater plants, Cyperus esculentus and Scirpus validus, was investigated under greenhouse control in a simulated freshwater marsh environment. Plants were grown on one coarse and two fine-textured sediments differing significantly in phosphorus and nitrogen contents. Growth of both species, measured as total biomass accrual during a two-month period, was greatest on silty clay, intermediate on clay, and least on sand. Both shoot density (number of shoots per area) and the specific mass of individual shoots with regard to sediment type demonstrated patterns identical to that of total biomass. Below to above ground biomass ratios were inversely related to plant growth. The fine-textured sediments provided proportionately greater above ground growth than the sand. Analysis of plant shoots indicated possible growth limitation by nitrogen on clay. Growth on silty clay was limited by neither nitrogen nor phosphorus, which were both present in the highest concentrations in this sediment. The biomass of both species on silty clay was within the range of most published estimates of the biomass of emergent freshwater plants in temperate regions of the world (Katz-EIS)
W79-04838

TRACE METALS IN THE COMMON MUSSEL, MYTILUS EDULIS (L.), AND IN THE ALGA FUCUS VESICULOSUS (L.) FROM THE REGION OF THE SOUND (ORESUND),
Uppsala Univ. (Sweden). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-04840

EDIBLE-OIL POLLUTION ON FANNING ISLAND,
Hawaii, Univ., Honolulu. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W79-04841

THE EFFECTS OF HEATED EFFLUENTS ON THE PRODUCTION OF MARINE PLANKTON (TAKAHAMA NUCLEAR POWER STATION-I) (IN JAPANESE),
Seikai Regional Fisheries Research Lab., Nagasake (Japan).
For primary bibliographic entry see Field 5B.
W79-04842

POLLUTION OF A WATER SUPPLY CATCHMENT BY BREEDING GULLS AND THE POTENTIAL ENVIRONMENTAL HEALTH IMPLICATIONS,
North West Water Authority (England).
For primary bibliographic entry see Field 5B.
W79-04843

ACUTE TOXICITY OF 12 INDUSTRIAL CHEMICALS TO FRESHWATER AND SALTWATER ORGANISMS,
Rice Univ., Houston, TX. Dept. of Biology; and Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5A.
W79-04845

A NEW AQUARIUM FOR THE STUDY OF TEMPERATURE BEHAVIOUR OF FISH,
Norsk Inst. for Vannforskning, Blindern (Norway).
For primary bibliographic entry see Field 5A.
W79-04846

USE OF CHLORINE TO CONTROL OTEC BIOFOULING,
Ecological Analysts, Inc., Melville, NY.
For primary bibliographic entry see Field 5B.
W79-04847

FLUX OF CERTAIN RADIONUCLIDES IN THE BLOOD-CLAM ANADARA GRANOSA LINNEAUS UNDER ENVIRONMENTAL CONDITIONS,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
For primary bibliographic entry see Field 5A.
W79-04849

ENVIRONMENTAL QUALITY RESEARCH. USE OF UNICELLULAR ALGAE FOR EVALUATION OF POTENTIAL AQUATIC CONTAMINANTS. SECOND ANNUAL REPORT,
California Univ., Irvine.
For primary bibliographic entry see Field 5A.
W79-04850

TEMPERATURE INFLUENCES ON GROWTH OF AQUATIC ORGANISMS,
Oak Ridge National Lab., TN.
C. C. Coutant, and J. S. Suffern.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-770516-9, Price codes: A02 in paper copy, A01 in microfiche. 1978. 13 p, 4 fig, 9 ref.

Descriptors: *Water temperature, *Growth rates, *Aquiculture, Aquatic life, Cooling water, *Thermal pollution, Heated water, Bass, Fish physiology, Animal metabolism, Effluents, Thermal stress.

Temperature profoundly affects the growth rates of aquatic organisms, and its control is essential for effective aquaculture. Characteristically, both low and high temperatures produce slow growth rates and inefficient food conversion, while intermediate temperature ranges provide rapid growth and efficient food conversion. Distinct, species-specific optimum temperatures and upper and lower temperatures of zero growth can often be defined. Thermal effects can be greatly modified by amounts and quality of food. These data not only provide the basis for criteria for maintaining growth of wild organisms but also for effectively using waste heat to create optimal conditions of temperature and food ration for growing aquatic organisms commercially. (Deal-EIS)
W79-04851

THE DISTRIBUTION AND ABUNDANCE OF SUBMERGED AQUATIC MACROPHYTES IN A REACTOR COOLING RESERVOIR,
Dupont de Nemours (E. I.) and Co., Aiken, SC. Savannah River Lab.
For primary bibliographic entry see Field 5B.
W79-04880

ADDED CHLORINE IN AQUATIC ENVIRONMENTS,
Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
E. V. Kalmaz.
The Journal of Environmental Sciences, Vol 21, No. 5/6, p 30-32, May/June 1978. 15 ref.

Descriptors: *Water pollution effects, *Chlorine, *Environmental effects, Resources development, Marine animals, Outer Continental Shelf, Reproductive failure, Chloramines.

The release of chlorinated water is producing effects that are slowly being better documented as a result of continuing research. The results of the recent studies show avoidance behavior and reproductive failure in fresh water invertebrates and fish at chlorine concentrations of .003 mb/l to .005 mg/l. Most of the regulations have been based on measurements of residual chlorine for both control of wastewater treatment and effluent limitations on power plants. Considering the strong sensitivity of aquatic organisms to residual chlorine and the present levels of chlorine use, substantial damage to aquatic resources may occur. The results of the studies of Duursma and others show that the chemistry of chlorine in estuarine and sea water is exceedingly complex, resulting in unique problems in analysis and interpretation of results. (Sinha-OEIS)
W79-04899

FLARE UP OVER NORTH SEA BIRDS,
B. Sage.
New Scientist, p 464-466, February 15, 1979. 1 photo.

Descriptors: *Water pollution effects, *Birds, Mortality, Oil pollution, Resources development, Environmental effects, Outer Continental Shelf, North Sea, Gas flares.

The Edinburgh office of the Royal Society for the Protection of Birds (RSPB) heard that early in October 1973, 'several hundred' storm-petrels were incinerated in a gas flare on a drilling rig in Shetland waters. According to this report, the carnage was so great that it was necessary to hose down the structure around the flare stack. From the information now available it is clear that a large number of birds have been killed at gas flares on exploration rigs and production platforms in the North Sea since at least 1973. With the exception of the storm petrel incident in Shetland in 1973, the reports have referred mainly to night-migrating land birds. October appears to be the critical time, and the incidents evidently occur on nights when it is damp with mist or light fog. (Sinha-OEIS)
W79-04900

A SIMPLE METHOD FOR SCREENING PETROLEUM EFFLUENTS BY IN VITRO ENZYME INHIBITION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.

C. L. Rutherford, A. L. Buikema, Jr., D. R. Armant, and J. Cairns, Jr.
Bulletin of Environmental Contaminant Toxicology, Vol. 21, p 79-84, 1979. 1 fig, 2 tab, 7 ref.

Descriptors: *Resources development, *Water pollution effects, *Enzymes, On-site tests, Environmental effects, Industrial wastes, *Outer Continental Shelf, Petroleum.

With the need to evaluate the environmental hazards of industrial wastes, there is increased demand for methods for quickly screening industrial effluents to determine if more sophisticated tests are needed, and, if they are, to establish priorities. While the animal systems currently being used for biological assessment are the best criteria for the final judgment of toxicant effect, simpler and less expensive methods for an initial on-site screening may be useful. The present research was aimed at developing a rapid and inexpensive method for screening of petroleum effluents. A procedure is described for determining the extent of enzyme inhibition by a simulated petroleum effluent which contained 'conventional contaminants.' (Sinha-OEIS)
W79-04902

OIL SPILLS: THE STRATEGY OF RECOVERY,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
J. M. Conrad.
Coastal Zone Management Journal, Vol. 4, No. 4, p 409-434, 1978. 2 fig, 8 tab, 6 ref.

Descriptors: *Oil spills, *Coasts, *Massachusetts, Water quality control, Water pollution control, Model studies, *Outer Continental Shelf, Recovery operations, Georges Bank.

A rational approach for determining the level and location of resources for recovery of oil from a nearshore spill is established. Its perspective is one of cost-effectiveness: If OCS development is to take place and recoverable reserves are found, how should oil spill recovery resources be deployed so as to minimize the impact of a nearshore spill. A general model for location of recovery resources is presented. The model is constructed so as to incorporate (1) indices of 'spill sensitivity' for different zones along a coastline, (2) spill probabilities for each zone, and (3) recovery rates based on initial location of recovery resources and deployment time. The problem of optimal location may be considered as an optimization problem where the instruments variables are deployment of 'recovery packages.' The problem then becomes one of locating such packages so as to minimize the expected damage from unrecovered oil, subject to resource availability and recovery technology. The general model is applied to coastal Massachusetts. Nine hypothetical situations are constructed, and an optimal deployment strategy is developed for each. The level of recovery commitment, which could be justified in terms of damage reduction is considered and alternative financial and operational arrangements that might be employed to provide the desired recovery potential are suggested. (Sinha - OEIS)
W79-04904

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, BOLIVAR PENINSULA MARSH AND UPLAND HABITAT DEVELOPMENT SITE, GALVESTON BAY, TEXAS; APPENDIX D: PROPAGATION OF VASCULAR PLANTS AND POST-PROPAGATION MONITORING OF BOTANICAL, SOIL, AQUATIC BIOTA, AND WILDLIFE RESOURCES,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 5E.
W79-04927

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX D: CHEMICAL AND PHYSICAL ANALYSES OF WATER AND SEDIMENT IN RELATION TO DISPOSAL OF DREDGED MATERIAL IN ELLIOTT BAY, VOL. I, FEB - JUNE 1976,
Corvallis Environmental Research Lab., OR. Marine and Freshwater Ecology Branch.
D. J. Baumgartner, D. W. Schults, and J. B. Carkin.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-24, June 1978 (in two volumes). 215 p, 8 tab, 27 fig, 6 ref, 6 append.

Descriptors: *Washington, *Aquatic environment, *Water analysis, *Waste disposal, *Bottom sediment, *Elliott Bay(WASH), *Dredged material disposal, *Waste disposal sites.

Over 100,000 m3 of dredged Duwamish River sediment were deposited in a controlled environmental dump site in Elliott Bay. Results obtained by monitoring physical and chemical parameters in the water column and sediment were evaluated regarding the effects of dredged material disposal in open estuarine waters. Parameters monitored in the water column included: suspended solids, pH, NH3-N, NO2 + nO3, ortho PO4-P, Cr, Hg, As, and Mn. Parameters monitored in the sediment included: moisture content, Eh, organic C, NH3-N, ortho PO4-P, alkaline soluble S, bulk and interstitial Cr, As, Mn, Hg, and particle size distribution. The monitoring program was conducted before, during, and at several intervals after dumping to determine the temporal and spatial impact associated with dumping activity. Data obtained showed dredged material fell rapidly to the seabed when discharged from the barge. Manganese, suspended solids, and ammonia were found to be above ambient in the water column at near-bottom sampling point. Manganese levels were equal to recommended limit, but such levels were found only shortly following each dump and is not expected to represent an ecological hazard. Long-term water quality monitoring showed only a small increase in suspended solids concentration near the bottom. (See also W79-04929) (WES)
W79-04928

VERTICAL MIGRATION OF BENTHOS IN SIMULATED DREDGED MATERIAL OVERBURDENS; VOL. I: MARINE BENTHOS,
Delaware Univ., Lewes. Marine Studies Complex.
For primary bibliographic entry see Field 5E.
W79-04931

DEVELOPMENT OF PROCEDURES FOR SELECTING AND DESIGNING REUSABLE DREDGED MATERIAL DISPOSAL SITES,
Acres American Inc., Buffalo, NY.
For primary bibliographic entry see Field 5E.
W79-04934

EVALUATION OF ALUMINUM SULFATE FOR PHOSPHORUS CONTROL IN EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Biological Sciences.
G. D. Cooke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 989, Price codes: A04 in paper copy, A01 in microfiche. Report, January 1979. 51 p, 5 fig, 19 tab, 39 ref. OWRT A-053-OHIO(1).

Descriptors: *Eutrophication, *Phosphorus, Lake restoration, Aluminum sulfate, Trophic state, Nutrient inactivation.

The response of eutrophic lakes to nutrient diversion is often less than expected because many lakes have internal recycling which keeps phosphorus (P) levels high enough to continue nuisance algal blooms. For these a restoration technique is required to achieve desired trophic state. This report describes the effectiveness of a hypolimnetic application of aluminum sulfate to Dollar Lake in 1974 and West Twin Lake (Ohio) in 1975 to control the release of P from anaerobic sediments. Septic tank diversion occurred in 1971. Lake monitoring in 1976 and 1978 supports the conclusion that alum application sharply curtailed internal P release and that P concentrations in the epilimnion and the whole lakes declined due to treatment. Epilimnetic P concentrations are less than half of pre-treatment years, and the lakes have very low cell volumes, an increase in abundance of phyla other than Cyanophyta, low chlorophyll, and higher transparency. The downstream untreated East Twin Lake improved in 1978 due to water of low P content from West Twin. The Carlson Trophic State Index shows that West Twin and Dollar Lakes were mesotrophic by 1976 and East Twin Lake by 1978. The treatment is effective for at least four years but some internal P release continues, supporting the belief that there are significant littoral P sources. A significant decline in the H' diversity of planktonic microcrustacea occurred after treatment.
W79-04958

STUDIES ON THE UPTAKE OF CADMIUM BY THE CRAB CARCINUS MAENAS IN THE LABORATORY. I. ACCUMULATION FROM SEAWATER AND A FOOD SOURCE,
Queen Mary Coll., London(England). Dept. of Zoology and Comparative Physiology.
For primary bibliographic entry see Field 5A.
W79-04968

STUDIES ON THE UPTAKE OF CADMIUM BY THE CRAB CARCINUS MAENAS IN THE LABORATORY. II. PRELIMINARY INVESTIGATION OF CADMIUM-BINDING PROTEINS,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
For primary bibliographic entry see Field 5A.
W79-04969

OCCURRENCE OF A NEW TYPE OF SHELLFISH POISONING IN THE TOHOKU DISTRICT,
Tohoku Univ., Sendai (Japan). Lab. of Food Hygiene.
For primary bibliographic entry see Field 5A.
W79-04970

EFFECT OF COPPER ON VOLUME REGULATION IN THE MARINE FLAGELLATE DUNALIELLA MARINA,
Miljostyrelsen, Charlottenlund (Denmark). Marine Pollution Lab.
H. U. Riisgard.
Marine Biology, Vol. 50, p 189-193, 1979. 3 fig, 16 ref.

Descriptors: *Copper, *Biological membranes, *Toxicity, Membrane processes, Ion exchange, Permselective membranes, Osmosis, Sodium, Potassium, Chlorine, Metals, Cytological studies, Biochemistry, Salinity, Animal physiology, *Flagellates, *Dunaliella.

The marine flagellate Dunaliella marina responds to hypotonic media in the same way as animal cells: an initial phase of osmotic swelling occurs, followed by a second, more prolonged phase of cell shrinkage - the volume-regulation phase. D. marina also volume-regulates in hypertonic media. This does not usually occur in animal cells exposed to normal concentrations of K+. Copper concentrations of 2 ppm and higher inhibit regulation of cell volume in D. marina transferred to hypotonic media. This is probably due to reduced cell-membrane permeability to K+ and/or Cl- and not to an interference with Na+/K+ exchange pump. These findings suggest that volume regulation is functionally independent of the Na+/K+ exchange pump. The method described herein appears to be a suitable biotest for pollutants, providing specific information on their effects on the permeability of cell membrane. (Deal-EIS)
W79-04972

CADMIUM TURNOVER IN THE SHORE CRAB CARCINUS MAENAS,
Newcastle-upon-Tyne Univ. (England). Dept. of Zoology.

For primary bibliographic entry see Field 5B.
W79-04973

HEAVY METAL ACTION ON TRANSINTEGUMENTARY ABSORPTION OF GLYCINE IN TWO ANNELID SPECIES,
Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).
D. Siebers, and U. Ehlers.
Marine Biology, Vol. 50, p 175-179, 1979. 4 fig, 15 ref.

Descriptors: *Heavy metals, *Absorption, *Annelids, Oligochaetes, *Mercury, *Cadmium, Salts, Copper, Toxicity, Digestion, Animal physiology, Animal metabolism, Radioactivity techniques, Carbon radioisotopes, Inhibition, Biochemistry, Amino acids, *Chromium, *Iron, *Lead, *Aluminum, *Nickel, *Manganese, *Cobalt, *Zinc, *Polychaetes, *Nereis, *Enchytraeus, *Silver, Glycine.

Absorption of 14C-glycine from ambient sea water across the body surface of the oligochaete Enchytraeus albidus was, after 6 h preincubation, significantly reduced in the presence of 0.1 to 0.15 ppm mercury, 0.25 ppm copper, 1.5 ppm silver, and 2 ppm cadmium. Addition of heavy metal salts reduced maximum uptake rates without affecting transport constants. Influx of 14C-glycine remained unchanged in the presence of up to 10 ppm aluminum, chromium, iron, lead, molybdenum, vanadium, and zinc. Effects of up to 150 ppm nickel, manganese, cobalt and selenium were negligible. Inhibition of glycine absorption by mercury and cadmium in the polychaete Nereis diversicolor is almost identical with results presented for E. albidus. Transintegumentary solute absorption in soft-bodied marine invertebrates obviously represents a suitable biological function for studies on heavy metal toxicity. The close relationship between rates of heavy metal absorption, inhibition of transintegumentary glycine uptake, and acute toxicity is discussed. (Deal-EIS)
W79-04974

UPTAKE FROM WATER AND TISSUE DISTRIBUTION OF NEPTUNIUM-237 IN CRABS, SHRIMP AND MUSSELS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W79-04975

DETERMINATION OF PETROLEUM HYDROCARBONS IN WATER, FISH AND SEDIMENTS FOLLOWING THE EKOFISK BLOWOUT,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.
For primary bibliographic entry see Field 5A.
W79-04976

5D. Waste Treatment Processes

ULTRAFILTRATION: A POTENTIAL METHOD TO TREAT POULTRY PROCESSING WASTEWATER WITH PROTEIN RECOVERED AS THE BY-PRODUCT,
North Carolina State Univ. at Raleigh. Dept of Poultry Science.
C. H. Shih.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 575, Price codes: A02 in paper copy, A01 in microfiche. The University of North Carolina, Raleigh, Completion Report, (1979). 10 p, 3 fig, 4 tab. OWRT A-00-NC(1).

Descriptors: Membrane ultrafiltration, *Poultry wastes, Poultry processing, Wastewater treatment, *Filtration.

Membrane ultrafiltration (UF) is a technique widely used today in industries and biochemical laboratories in the process of concentration and separation of macromolecules such as proteins. The development of membrane technology allows the membrane to withstand high pressure and display high hydraulic permeability. Proteins and fats which come from the carcass debris and the blood are the major 'pollutants' in the processing wastewater. They are of high nutritional value and should be recovered for refeeding. To serve this purpose, UF is a process of promise to treat the wastewater prior to discharge and to recover proteins and fats as the by-products. With a small lab-scale operation of hydraulic pressure of 20 psi, a filtration rate of 15-20 GPD/ft2 was obtained. The protein concentrations (mg/l) were 400 in the original wastewater, 50 in the filtrate, and 1,200 in the concentrate which can be dried to harvest the protein. The COD value (mg/l) dropped from 752 in the wastewater to 32 in the filtrate which may be directly discharged into the stream.(Kiger-North Carolina).
W79-04501

ASSESSMENT OF BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE FOR SYNTHETIC RUBBER MANUFACTURING WASTEWATER,
Abcor Inc., Wilmington, MA. Walden Div.
For primary bibliographic entry see Field 6B.
W79-04525

MUNICIPAL WASTEWATER AQUACULTURE,
Robert S. Kerr Environmental Research Lab., Ada, OK. Wastewater Management Branch.
W. R. Duffer, and J. E. Moyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 352, Price codes: A04 in paper copy, A01 in microfiche. EPA-600/2-78-110, June 1978. 46 p, 9 tab, 71 ref.

Descriptors: *Aquiculture, *Municipal wastes, *Waste water treatment, *Reviews, *Water reuse, *Tertiary treatment, *Beneficial use, Economics, Sewage lagoons, Foods, Water pollution control, Waste water disposal, Invertebrates, Midges, Larvae, Water hyacinth, Eichhornia crassipes, Fish, Macrophytes, Path of pollutants, Wetlands, Public health, Seaweed, Algae, Organic wastes, Research priorities.

Literature of June 1977 on the developmental status of aquaculture as an alternative method for treatment and reuse of municipal wastewater was reviewed. Current technology is not adequate for designing operational aquacultural treatment systems, but several types of organisms hold considerable potential. Only new or developmental processes were considered, and conventional or advanced application processes were excluded. Systems examined included natural wetlands, artificial wetlands, macrophytes, invertebrates, fish, and integrated or food chain units. Major emphasis was given to the reduction or fate of such pollutants as organics, solids, nutrients, heavy metals, residual hydrocarbons, and potentially pathogenic organisms. Economic assessments of treatment and production rates for organisms are provided for several types of aquacultural processes, and areas having high potential for further research and development are identified. Conclusions: (1) water hyacinth, seaweed, and midge larvae show particular promise; (2) freshwater systems have a distinct advantage over marine systems as much smaller volume of water is required; (3) use of aquaculture for producing human food, which has been the major focus of research to date (with little devoted to wastewater treatment or reuse), is hampered in wastewater treatment by disease transmission and social acceptance, and other products should be investigated; (4) economic return on such products may be small, but energy savings may be realized; and (5) aquaculture may be most applicable in combination with other treatment methods. (Lynch-Wisconsin)
W79-04528

SOURCE ASSESSMENT: RAIL TANK CAR, TANK TRUCK, AND DRUM CLEANING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
D. E. Earley, K. M. Tackett, and T. R. Blackwood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 726. Price codes: A04 in paper copy, A01 in microfiche. EPA-600/2-78-004g, April 1978. 56 p, 23 tab, 22 ref, 2 append. 68-02-1874.

Descriptors: *Water pollution control, *Air pollution, *Tank trucks, *Cleaning, *Tank cars, *Drums, *Environmental effects, *Water pollution sources, *Waste water treatment, Railroads, Point pollution, Air pollution effects, Water pollution effects, Transportation, Chemicals, Oil pollution, Oil, Suspended solids, Total oxygen demand, Phenol, Grease, Industrial wastes, Organic compounds, Gases.

Assessment of control methods and environmental impacts of cleaning rail tank cars, tank trucks, and drums which carry organic chemicals and petroleum products indicates that without more stringent controls air emissions will increase an estimated 30% through 1980, equal to the projected increase in chemical production. Increased wastewater treatment could reduce discharged water pollutants 50% by 1980. This report excludes gasoline, diesel and fuel oils, jet fuels, and motor oils. Carriers in dedicated service (the majority) are cleaned only prior to repair or testing. Nondedicated tank trucks and drums are cleaned after every trip to prevent cross-contamination; unit cleanings per year total 37,200 rail tank cars, five million tank trucks, and 24.7 million drums. Steaming, washing, and/or flushing cause air emissions and wastewater effluents. Air emissions from tank cars and trucks are predominately organic chemical vapors, each industry contributing less than 0.0022% of national hydrocarbon emissions. Water pollutants produced are primarily oil and grease, total effluent oxygen demand (TOD), suspended solids, and phenol. Emission control methods for tank cars and trucks include flaring, absorption, and product recovery of flushed gases. No practical control methods exist for drum washing. Emissions from drumburning furnaces are controlled by proper operating conditions. Wastewater treatment consists of a variety of physical, chemical, and biological processes. (Lynch-Wisconsin)
W79-04529

COAL HUMIC SUBSTANCES FOR THE TREATMENT OF WASTEWATER FROM STACK GAS SCRUBBERS, COAL CONVERSION PLANTS, AND OTHER COAL UTILIZATION FACILITIES,
Missouri Univ.-Columbia. Dept. of Chemistry.
S. E. Manahan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 501, Price codes: A03 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri. Completion Report, December 27, 1978. 35 p, 8 fig, 6 tab. OWRT-A-106-MO(2). 14-34-0001-8027.

Descriptors: *Coal, *Wastewater treatment, *Humic acid, Organic compounds, Fly ash, Oil shale, Carbon-14.

Coal humic substance is a complex organic material prepared by the partial oxidation of coal. This report deals with the uses of coal humic substances for wastewater treatment. The first section is a review of humic substances and their applications to wastewater treatment. The second portion deals with laboratory studies of coal humic substances used for wastewater treatment. The removal of radiolabelled organic compounds from wastewater is described. The interaction of coal humic substances and fly ash is also discussed. Certain types of fly ash are possible sources of base for the preparation of coal humates from coal humic acid. The interaction of coal humic acid with fly ash is compared to that between fly ash and salicylic acid, a low molecular weight analog of one of the major structural entities in coal humic substances.
W79-04554

REMOVAL OF AMMONIA NITROGEN FROM WASTEWATER BY PARTIAL CHLORINA-

TION FOLLOWED BY ACTIVATED CARBON TREATMENT,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
Ju-Chang Huang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 502, Price codes: A06 in paper copy, A01 in microfiche. Missouri Water Resources Reseach Center, University of Missouri Completion Report, November, 1978. 109p, 25 fig, 23 tab, 31 ref. OWRT-A-093-MO(1), 14-34-0001-7053-7054-8027.

Descriptors: *Activated carbon, *Ammonia nitrogen, Catalytic oxidation, *Chlorination, Wastewater treatment, Chloramines.

The objective was to investigate the feasibility of removing NH3-N from wastewater by first converting it to chloramines by partial chlorination and then removing the latter by activated carbon treatment. The first phase of the study was to evaluate the formation and stability of mono- and di-chloramines in aqueous solutions of different pH and different Cl2/NH3-N ratio. The second phase was to evalute the quantitative interactions between activated carbon and each species of chloramines. The relative distributions of mono-and di-chloramines were dependent mainly on pH and, to a lesser degree, on the ratio of Cl2/NH3-N. In contacting with carbon, both mono- and di-chloramines disappeared quickly. The disappearance of dichloramine was generally accomplished by catalytic oxidation of its nitrogen entity to nitrogen gas. However, the loss of monochloramine was generally accompanied by about 60% reversion of its nitrogen content to ammonia. The quantity of this reversion was not reduced by 'precharging' the activated carbon with 'surface oxides'. Thus, it is concluded that the technique using partial chlorination followed by activated carbon treatment is not very effective in removing ammonia nitrogn from wastewater.
W79-04556

PAPERMAKING PRIMARY SLUDGES. DEWATERING STUDIES REALIZED WITH DIFFERENT INDUSTRIAL DEVICES (BOUES PRIMAIRES DE PAPETERIE. ESSAIS DE DESHYDRATATION REALISES AVEC DIFFERENTS APPAREILS INDUSTRIELS),
B. Bianchin, G. Gervason, P. Vallette, and G. Sauret.
ATIP (Association Technique de l'Industrie Papetiere) Revue, Vol. 32, No. 4, p 133-147, April, 1978. 15 fig, 11 tab.

Descriptors: *Sludge treatment, *Dewatering, *Pulp and paper industry, Wastes, Industrial wastes, Water pollution sources, Solid wastes, Sludge, Equipment, Flocculation, Centrifugation, Water quality control, Pulp wastes, Presses, Belt presses, Screw presses, Filters.

Paper mill sludge dewatering tests were conducted using eight different industrial units. With the exception of the Guva filter tower, the belt presses (e.g., the Andritz-SFM 500) generally gave dewatered sludge cakes with a dryness above 40% (50% with optimum control) at a good level of retention. With the Bellmer converging-belt press, the addition of flocculating agents was necessary for good retention due to the coarseness of the wire belts. The Tasster F (a screw press) gave resuls of the same order. Interesting results were also obtained with a prototype of the Bertin dewatering press. The Westfalia and Sharpless centrifuges gave dewatered sludge dryness contents of 32-39% at retention levels above 90%. This type of device permits high operating flexibility and gives a dewatered sludge in granular rather than continuous web form. The Choquenet filter press yielded sludge at a dryness of 34-44%, but was tested only under laboratory conditions. In all cases, the devices were tested in parallel with a Philippe suction-drum filter, which yielded sludges of 29-36% dryness. (Speckhard-IPC)
W79-04581

SEWER NETWORK SCHEME FOR DIGITAL COMPUTATIONS,
Texas Univ. at Austin. Dept. of Civil Engineering.
L. W. Mays.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE3, Technical Note, p 535-539, June 1978. 3 fig, 4 ref, 1 append. OWRT C-4123(No.9023)(11).

Descriptors: *Network design, *Sewers, *Mathematical models, Algorithms, Computer models, Systems analysis, Sanitary engineering.

Several computer algorithms have been reported in the literature for optimal design of sewer systems, for performing hydraulic routing computations, and for various types of simulation models. A simple scheme has been developed and was presented that can be used to describe the physical arrangement of multi-level branching sewer networks for digital manipulation in computer usage. This approach for network representation uses the concepts of isonodal lines, a nodal numbering scheme, and vector of connectivity that are all generated internally in the computer from a simple and arbitrary list of node numbers. This approach has been found to be quite advantageous in both optimization models and hydraulic simulation models. The author has applied this scheme very successfully to the entire sanitary sewer network of Fort Lee, Virginia, which has over 1,000 sewer pipes. (Humphreys-ISWS)
W79-04590

ANAEROBIC DIGESTION AND MEMBRANE SEPARATION OF DOMESTIC WASTEWATER,
Thayer School of Engineering, Hanover, NH.
H. E. Grethlein.
Journal Water Pollution Control Federation, Vol. 50, No. 4, p 754-763, April, 1978. 3 fig, 4 tab, 8 ref. OWRT-A-034-NH(3), 14-31-0001-4029.

Descriptors: *Anaerobic digestion, *Membrane processes, *Septic tanks, *Reverse osmosis, *Domestic wastes, Semipermeable membranes, Filters, Biochemical oxygen demand, E. coli, Nitrates, Phosphates, Turbidity, Waste water treatment, Municipal wastes.

A domestic septic tank was converted to an aerobic digester with a variable stroke piston pump and equipped with a flat sheet semipermeable membrane module and a Helicore reverse osmosis unit operated in cyclic and continuous flow patterns. Under an on-off cyclic operating time of 2 min, a steady flux of 490 liters/sq m/day was achieved with the flat sheet membrane at a bulk velocity of 22.9 cm/sec. The membrane did not foul during cyclic operation because of the backflow when the pump was turned off. Flux during cyclic operation was maintained in the flat semipermeable membrane for 1,500 hrs and in the reserve osmosis membrane for 8,500 hrs. A bulk fluid velocity of 15.2-122 cm/sec over the membrane surface was possible, depending upon the operating cycle. The anaerobic digestion rate within the septic tank more than tripled because of higher concentrations of microorganisms and substrate; BOD was reduced by 85-95%. The system completely removed turbidity and E. coli and reduced nitrate by about 75%. The process by which insoluble phosphate was removed could not be identified. (Lisk-FIRL)
W79-04597

ELECTROCHEMICAL COAGULATION OF INDUSTRIAL EFFLUENTS (ELEKTROKHIMICHESKAYA KOAGULYATSIYA PROMYSHLENNYKH STOKOV),
Irkutskii Inst. of Organic Chemistry (USSR).
E. N. Serdobol'skii, V. A. Babkin, M. I. Anisimova, G. R. Bochkarev, and V. I. Rostovtsev.
Bumazhnaya Promyshlennost', No. 6, p 11-12, June, 1978. 1 fig, 3 tab.

Descriptors: *Bleaching wastes, *Waste water treatment, *Electrochemistry, Wastes, Industrial wastes, Water pollution treatment, Waste treatment, Water pollution sources, Pulp and paper industry, Effluents, Pulp wastes, Anodes, Aluminum, Iron, Pilot plants, Coagulation, Neutralization, Chemical oxygen demand, Color, Carbon, Phenols, Lignins, Daphnia, Toxicity, Waste dilution, Dissolving pulp, Aquatic life.

Effluents from the alkaline extraction of chlorinated dissolved pulp and a 1:1 mixture of this effluent with effluent from pulp chlorination were purified by electrochemical coagulation in pilot-plant experiments. The alkaline extraction effluent was neutralized with sulfuric acid prior to treatment. The anodes used were iron and aluminum. The pilot-plant equipment of 2.4-3 cu m/hr capacity is described and illustrated. The following reductions were achieved: COD, 82.4-91.4%; color, 94-98%; chlorolignin content, 93.8-99%; total carbon, 82.8-90.7%; and volatile phenols, 98.1-100%. Generally better results were obtained with aluminum than with iron anodes. Biological experiments conducted on Daphnia indicated a considerable reduction of effluent toxicity after purification and dilution. (Stapinski-IPC)
W79-04630

PILOT-PLANT STUDY OF TWO-STAGE CHEMICAL-BIOLOGICAL PURIFICATION OF PULPING EFFLUENTS AT THE OSTROLEKA PULP AND PAPER MILL (BADANIA POLTECHNICZNE NAD OCZYSZCZANIEM SCIEKOW CELULOZOWYCH Z OSTROLECKICH ZAKLADOW CELULOZOWO-PAPIERNICZYCH W UKLADZIE DWUSTOPNIOWYM CHEMICZNO-BIOLOGICZNYM),
Technical Univ. of Warsaw (Poland). Inst. Zaopatrzenia w Wode i Budownictwa Wodnego.
M. Apolinarski, M. Roman, Z. Ulaska, E. Skowyrski, and J. Zielinski.
Przeglad Papierniczy, Vol. 34, No. 7, p 268-272, July, 1978. 6 fig, 1 illus, 17 ref, 2 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Biological treatment, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Foreign countries, Pilot plants, Coagulation, Calcium hydroxide, Sedimentation, Carbon dioxide, Activated sludge, Biochemical oxygen demand, Chemical oxygen demand, Color, Filtration, Sludge, Dewatering, Sludge treatment, Europe, Poland, Kraft mills.

Studies of kraft pulp mill effluent purification conducted over a 3-yr period have shown that the best results are obtained by a two-stage chemical-biological treatment. Data obtained in model experiments were utilized for the design of a pilot-plant purification system at the Ostroleka (Poland) pulp and paper mill. In the model system, effluent is first treated with milk of lime, and the precipitate is allowed to settle and then saturated with carbon dioxide. Following post-saturation sedimentation, the effluent is purified by the activated sludge process. Compared to the conventional biological purification method (now operating at the Ostroleka mill), the two-stage process gave higher efficiency of purification, about 10% for 5-day BOD, 40% for COD, and 85% for color removal. The preliminary chemical treatment did not affect the activity of the activated sludge. The post-saturation sediment has the lowest filtration resistance. A mixture of sediments and excess activated sludge could be dewatered mechanically. (Stapinski-IPC)
W79-04631

APPLICATION OF REVERSE OSMOSIS AND ULTRAFILTRATION TO PURIFICATION OF PULP AND PAPER INDUSTRY EFFLUENTS. VI. PURIFICATION OF PULP BLEACHING EFFLUENTS (ZASTOSOWANIE ODWROCONEJ OSMOZY I ULTRAFILTRACJI DO OCZYSZCZANIA SCIEKOW Z PRZEMYSLU CELULOZOWO-PAPIERNICZEGO),
Instytut Inzynierii Ochrony Srodowiska Politechniki Slaskiej, Gliwice (Poland).
M. Bodzek, O. Kominek, E. Kowalska, and I. Tanistra.
Przeglad Papierniczy, Vol. 34, No. 7, p 248-251, July, 1978. 12 ref, 5 tab. English summary.

Descriptors: *Bleaching wastes, *Waste water reatment, *Reverse osmosis, Pulp wastes, Wastes, ndustrial wastes, Waste treatment, Water pollu- ion treatment, Water pollution sources, Pulp and aper industry, Effluents, Membrane processes, Cellulose, Membranes, Separation techniques, Chemical oxygen demand, Color, Chlorides, Con- luctivity, Ultrafiltration, Temperature, Filters.

Effluents from each stage of a bleaching sequence or sulfite pulp (CEHH) and for kraft pulp (CEHD) were subjected to ultrafiltration (UF) and everse osmosis (RO) through cellulose acetate nembranes. The effectivenss of the two processes vas evaluated by determinations of the mean filtra- ion rate and the reduction of pollution load. UF gave reductions in color up to 95%, in average COD of 70%, and in oxidizability of 80%. The eduction in content of soluble substances did not xceed 50%, and the reductions in chloride con- ent and conductivity were low (10-20% and 18- 5%, respectively). The effectiveness of RO de- ended on the temperature of the membrane treat- nent; the best results were obtained at 80C. Such nembranes attained over 80% reduction of all ollution indicators. Clogging of cellulose acetate nembrane pores did occur, causing a reduction of he filtration rate, accompanied by a higher aver- ge degree of purification. Although purification vas lower than in the case of pulp washing ef- luents, the use of UF and RO appears promising. Stapinski-IPC)
W79-04632

CRITERIA FOR SELECTING INSTALLATIONS FOR FIBER RECOVERY (AUSWAHLKRITER- EN FUER ANLAGEN ZUR FASER- RUECKGEWINNUNG),
Voith (J. M.) G.m.b.H., Heidenheim (Germany, F.R.).
. Velinsky.
Vochenblatt fuer Papierfabrikation, Vol. 106, No. 4, p 533-536, 538, July 31, 1978. 2 fig, 6 ref.

Descriptors: *Pulp wastes, *Fiber recovery, Waste water treatment, Wastes, Industrial wastes, Water pollution treatment, Waste treatment, Water ollution sources, Pulp and paper industry, Ef- luents, Sedimentation, Filtration, Flotation, White vater(Paper machines), Closed systems, Water onservation, Industrial water.

Fiber recovery from paper machine white water or aper mill effluent can also be called water clarifi- ation, depending on where the emphasis lies in a articular system. The three processes in common se are described and discussed, namely, sedimen- ation, filtration, and flotation. The advantage and isadvantages of each are compared, and the suit- bility of each for various types of operation is ndicated. The effect closing the paper-machine vater circuit is briefly discussed. (Ward-IPC)
W79-04633

REMOVAL OF COLOR FROM CARBONATE PULPING EFFLUENT -- THE CALCIUM-MAG- NESIUM COAGULATION PROCESS,
nstitute of Paper Chemistry, Appleton, WI.
. G. Lathis, and T. W. Joyce.
Tappi, Vol. 61, No. 10, p 67-70, October, 1978. 4 g, 11 ref, 4 tab.

Descriptors: *Pulp wastes, *Decoloring, *Coagula- on, *Waste water treatment, Wastes, Industrial vastes, Water pollution sources, Water pollution reatment, Pulp and paper industry, Effluents, Color, Calcium compounds, Magnesium com- ounds, Waste treatment, Hydrogen ion concentra- on, Sludge, Chemical precipitation, Spent pulping quors, Carbonate pulping, NSSC(Neutral Sulfite emichemical) pulping.

The influence of the trend to replace neutral sulfite emichemical (NSSC) pulping with carbonate ulping on the Ca-Mg coagulation process for ffluent color removal was studied at the Institute f Paper Chemistry (Appleton, Wis.). Good color emoval from spent carbonate pulping liquor can e obtained by using 300 ppm Ca at pH 12. Com- arisons of IR spectra of carbonate and NSSC effluents indicated that carbonate effluent contains insignificant amounts of lignosulfate and carboxy- lic acid groups. The presence of lignosulfate is undesirable in color removal because it forms a partially soluble salt with bivalent metals. The color removal mechanism is best understood by considering the reaction of Ca-Mg with an acidic functional group (e.g., carboxyl, keto-enolic, and phenolic hydroxyl groups) in the organic com- pounds in spent pulping liquors. Magnesium is not required in the color removal process for carbon- ate effluents, since it reacts primarily with carboxy- lic acid groups. The color removal process is re- versible and highly dependent on pH. Reducing pH to about 7.6 will redissolve the sludge, and the effluent will regain its original color. (Switchten- berg-IPC)
W79-04635

TOXICITY REMOVAL BY PRIMARY TREAT- MENT (OF KRAFT PULP MILL EFFLUENT),
Institute of Paper Chemistry, Appleton, WI.
E. T. Muehlethaler.
In: Proceedings of the Institute of Paper Chemistry (Appleton, Wisconsin) 42nd Executives Confer- ence, May 10-11, 1978. p 32-33.

Descriptors: *Pulp wastes, *Waste water treat- ment, *Detoxification, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Waste treatment, Pulp and paper industry, Effluents, Bioassay, Chemical precipitation, Flota- tion, Toxicity, Fish, Aquatic animals, Aluminum sulfate.

Laboratory bioassays conducted at the Institute of Paper Chemistry (Appleton, Wisconsin) investigat- ed the comparative effectiveness of two effluent primary treatment methods, viz., solids precipita- tion with alum vs. flotation with dissolved air, in reducing the fish toxicity of untreated kraft pulp mill effluent in terms median survival time (MST) at which 50% of test organisms are still alive in tanks containing a given effluent concentration. For the particular effluent used, neither of the two treatment processes was better than the other. At the concentrations used (20%), untreated effluent gave MST values of 7.5-8.0 hr, compared to 31.5- 46.5 hr for effluent after dissolved-air flotation. (Brown-IPC)
W79-04637

ADVANCED STEPS TOWARDS THE POLLU- TION-FREE BLEACHED SULFITE MILL,
IVL-Consulting Ltd., Goteborg (Sweden).
For primary bibliographic entry see Field 3C.
W79-04639

EXTRACTING LIGNINS FROM MILL WASTES,
National Aeronautics and Space Administration, Pasadena, CA. Jet Propulsion Lab.
M. F. Humphrey.
Southern Pulp and Paper Manufacturer, Vol. 41, No. 9, p 27-28, September, 1978. 1 fig, 1 tab.

Descriptors: *Pulp wastes, *Lignins, *Separation techniques, *Waste water treatment, Wastes, In- dustrial wastes, Pulp and paper industry, Effluents, Water pollution treatment, Water pollution sources, Ammonium compounds, Chemical pre- cipitation, Activated carbon, Sludge, Sludge treat- ment, Filtration, Hydrogen ion concentration, Dis- tillation, Recycling, Quaternary ammonium com- pounds.

Quaternary ammonium compounds are used to precipitate lignins and colored lignin degradation products from pulp and paper mill effluents, and activated carbon is used to absorb other contami- nants to obtain purified and reusable water. The sludge is filtered, and the cake is transferred to a dissolving tank where methanol is added to dis- solve the quaternary ammonium derivatives of lignin. The slurry is filtered to remove the solids which are pyrolyzed to produce activated carbon, while the solution if fed to a lignin precipitation tank. When the methanolic solution is acidified, quaternary ammonium compounds become soluble and lignins insoluble; therefore a mineral acid such as sulfuric, hydrochloric, or phosphoric acid is used to adjust the pH to 2-2.5. The resultant slurry is filtered to remove the lignin solids, while the methanol is recovered by distillation. The remain- ing quaternary ammonium salts are adjusted to pH 5-8 and recycled. (Louden-IPC)
W79-04640

FILTER BELTS VS. PRESSURE IN DEWATER- ING OF SLUDGES,
National Council of the Paper Industry for Air and Stream Improvement, Inc., Kalamazoo, MI.
D. W. Marshall.
Southern Pulp and Paper Manufacturer, Vol. 41, No. 9, p 23-26, September, 1978. 2 tab.

Descriptors: *Sludge treatment, *Dewatering, *Pulp and paper industry, Pulp wastes, Wastes, Waste treatment, Solid wastes, Operation and maintenance, Filtration, Sludge, Electric power, Screens, Equipment.

Filter-belt presses are usually used to dewater pulp and paper mill sludges that are difficult to filter or centrifuge. These presses require more sludge con- ditioning than do some other processes. Power requirements and cake consistencies are good. Per- formance figures are cited. Operating problems are largely associated with start-up and refinement of machinery; the more common difficulties include bearing failures, belt tracking problems, and occa- sional belt tearing. Inclusion of a screening device might be useful to remove large pieces of debris from the feed. Pressure filtration is the most com- monly used alternative. Precoat utilization is not always necessary. Startup problems with pressure filters can be substantial; the more common diffi- culties include plate warping or breakage, media tearing, poor sludge and/or precoat distribution within the chambers, and malfunction with timing and plate shifting devices. Pilot and full-scale data are given for both types of equipment. (Louden- IPC)
W79-04641

REAGENT-FREE METHOD OF EFFLUENT NEUTRALIZATION (BEZREAGENTNYI SPOSOB NEITRALIZATSII STOCHNYKH VOD),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
V. P. Semenov, V. V. Popov, and V. V. Gulyaev.
Bumazhnaya Promyshlennost', No. 6, p 4-5, June, 1978. 2 tab.

Descriptors: *Pulp wastes, *Waste water treat- ment, *Neutralization, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Ef- fluents, Aluminum, Sulfates, Lime, Hydrogen ion concentration, Carbon dioxide, Sedimentation, Alkalis(Bases), Aeration, Costs, Water pollution control, Sodium hydroxide.

The neutralization of kraft mill effluents following their chemical purification with aluminum sulfate is usually done with NaOH or lime. It has been observed that the pH increases after sedimentation of the treated effluent. The concentration of free carbon dioxide increases during chemical purifica- tion, and during sedimentation of the purified efflu- ent the carbon dioxide is released into the atmos- phere and the pH increases. The process is slow, however, and the pH may not reach the necessary level of 6.8. A method is proposed for accelerating this process and at the same time avoiding the use of alkali for neutralization of the chemically puri- fied effluent. The method involves aerating the treated effluent for about 10 min to drive off the excess carbon dioxide. The initial pH of the chemi- cally treated effluent should not be lower than 5.4- 5.5 to obtain a final pH of 6.8. The method reduces the cost of purification and the mineral content of the effluents, due to the elimination of the alkaline neutralization reagents. (Stapinski-IPC)
W79-04642

MECHANISM OF ALUMINUM SULFATE RECOVERY FROM LIGNIN SLUDGE (MEKHANISM IZVLECHENIYA SULFAT ALYUMINIYA IZ SHLAM-LIGNINA),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
M. B. Berov, and V. M. Shapchenko.
Bumazhnaya Promyshlennost', No. 6, p. 13-14, June, 1978. 3 fig.

Descriptors: *Pulp wastes, *Lignins, *Aluminum sulfate, *Sludge, *Chemical recovery, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Costs, Hydrogen ion concentration, Cations, Waste treatment, Solid wastes, Separation techniques, Coagulation sulfur compounds, Kraft mills.

The high cost of aluminum sulfate prevents its widespread use in the chemical purification of pulp and paper industry waste waters. Recovery and reuse of this coagulant would help reduce overall consumption. Recovery of aluminum sulfate is possible with the development of a method of dewatering lignin sludge obtained in chemical purification of kraft mill effluents. The relation between the degree of aluminum recovery and the pH and time of the reaction and the amount of sulfuric acid was studied. A mechanism is proposed for the aluminum recovery process. The sludge formed during treatment of the effluent consists of a lignin-aluminum adduct and aluminum sulfate hydrolysis products. During the recovery process, the acid reacts with both these components, yielding aluminum cations and polycations of the adduct. The solubilization of the adduct polycations is due to replacement of aluminum by the acid protons There is no complete solubilization, however, because of the formaton of intermolecular H-bonds and the low solubility of lignin in acidic media. The amount of polycations in the recovered reagent depends on the pH and is maximum at pH 2.5-2.7. (Stapinski-IPC)
W79-04643

DEWATERING OF HIGH-ASH SEDIMENTS OF EFFLUENTS (OBEZVOZHIVAMIE VYSOKOZOLINYKH OSADKOV STOCHNYKH VOD),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
A. I. Volkov, Yu. I. Chernousov, M. L. Murskaya, S. S. Bykova, and A.-V. S. Mil'vidas.
Bumazhnaya Promyshlennost', No. 6, p. 5-6, June, 1978. 3 fig.

Descriptors: *Dewatering, *Sludge treatment, *Pulp and paper industry, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Foreign countries, Centrifugation, Sludge, Solid wastes, Waste treatment, Soviet Union (USSR), Board mills, Polyacrylamide, Aluminum sulfate, Effluents.

The increasing application of centrifugation for dewatering effluent sludge is due to the higher efficiency of this method compared to dewatering by vacuum or pressure filtration. To determine the optimum parameters of centrifugal dewatering, experiments were conducted at the Klaipeda pulp and board mill (USSR) with the OGSh-321 K-5 centrifuge and sedimentation pond sludge containing up to 80% ash. Bark, chips, and other large particles were removed from the sludge, and the sludge was centrifuged directly or after the addition of varying amounts of polyacrylamide and/or aluminum sulfate. The recommened load for dewatering the Klaipeda mill sludge is 3.5-4 cu m/hr at an initial concentration of 30-38.2 g/liter and solid-phase ash contents of 33-48.7%. The addition of polyacrylamide had little effect on the process variables, while the addition of aluminum sulfate in some cases lowered the efficiency of the centrifuge. (Stapinski-IPC)
W79-04644

DYNAMICS OF EFFLUENT CLARIFICATION (DINAMIKA OSVETLENIYA STOCHNYKH-VOD),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
G. P. Kuchin, E. M. Bakaeva, I. A. Evstigneev, and L. A. Makarova.
Bumazhnaya Promyshlennost', No. 6, p 8-9, June, 1978. 2 fig.

Descriptors: *Pulp wastes, *Sedimentation, Waste water treatment, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Suspended solids, Particle size, Fluid mechanics, Hydraulic properties, Hydrodynamics.

Effluents from the manufacture of several types of paper were placed in one-liter cylinders and left undisturbed for 5-120 min. Experimental curves showing the clarification effect as a function of the hydraulic coarseness of particles (i.e., ratio of the water column height to sedimentation, mm/sec) and of the sedimentation rate reveal that at the same hydraulic coarseness of suspended particles, the clarification effect is different for different types of effluents. This indicates different agglomeration capacities of the solids. Most kinetic curves of clarification show two zones, a zone of rapid sedimentation (about 30 min) and a zone of slow sedimentation. There was no initial rapid sedimentation phase for some types of effluents. The degree of final clarification also depended on the type of effluent. It was 100% for effluents from the manufacture of fillerless papers, lower for filled papers, and only 50% for effluent from groundwood-containing papers. (Stapinski-IPC)
W79-04645

UTILIZATION OF EVAPORATOR CONDENSATES AS A REPLACEMENT FOR FRESH WATER (ISPOL'ZOVANIE KONDENSATOR VYPARNOGO TSEKHA VZAMEN SVEZHEI VODY),
Sibirskii Nauchno-Issledovatelskii Inst. Tsellyulozy i Kartona (USSR).
G. E. Danilov, V. R. Namsaraeva, A. Kh. Namsaraeva, M. I. Babchuk, and A. G. Berdyshev.
Bumazhnaya Promyshlennost', No. 6, p 24-25, June, 1978. 1 fig, 2 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Condensates, *Water reuse, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Foreign countries, Odor, Lime, Evaporators, Water pollution control, Recycling, Soviet Union(USSR), Pulp washing, Industrial water, Water conservation.

Evaporator condensates from the Selenga (USSR) pulp and paper mill were analyzed for their degree of pollution. The analyses showed that condensates from effects (plates)2, 3, and 4 are the least polluted. Condensates from effects 5 and 6 have a high concentration of pollutants and a strong odor, and cannot be recommended for reuse. A system was developed for feeding condensates from effects 2, 3, and 4 into the hot water tank to be used for washing of pulp and of causticization mud. The more polluted condensates are deordorized and discharged. However, it is planned to use these condensates in the future for washing causticization mud and for recovery of lime. The use of condensates does not affect the quality of the pulp and significantly lowers the load of the purification equipment. (Stapinski-IPC)
W79-04646

RESEARCH ON PULP AND PAPER INDUSTRY WATER AND EFFLUENT QUALITY PROBLEMS -- A REVIEW,
British Columbia Research Council, Vancouver.
For primary bibliographic entry see Field 5C.
W79-04668

PREDICTIVE MODEL FOR DESIGN OF FIXED-BED ADSORBERS: PARAMETER ESTIMATION AND MODEL DEVELOPMENT,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
J. C. Crittenden, and W. J. Weber, Jr.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE2, p. 185-197, April 1978. 5 fig, 1 tab, 34 equ. 14 ref.

Descriptors: *Model studies, *Adsorption, *Diffusion, *Waste water treatment, *Fixed-bed models, *Kinetics, Mass transfer, Numerical analysis, Isotherms, Parameters, Design, Programs, Evaluation, Effects, Methodology, Prediction, Systems analysis, Equations.

A predictive mathematical model for fixed-bed adsorber design which incorporates both liquid and solid phase resistances to mass transfer is formulated: numeric solutions are described and checked for accuracy. Laboratory bench scale studies used to estimate model parameters independently from adsorber break-through profiles are described, and experimental results are presented. The bench scale tests involve both adsorption rate and isotherm measurements that are used to determine isotherm equation parameters and surface diffusion coefficients for model calibration. Liquid-phase mass transfer coefficients for fixed-bed operation are obtained from literature correlations; parameter values used for model calibration are presented. This paper sets the stage for single- and multi-component model verifications to be presented in two subsequent papers. (Bell-Graf--Cornell)
W79-04704

EVALUATION OF EPA RECOMMENDED TREATMENT AND CONTROL TECHNOLOGY FOR BLAST FURNACE WASTEWATER,
Carnegie-Mellon Inst. of Research, Pittsburgh, PA.
G. M. Wong-Chong, and S. C. Caruso.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE2, p. 305-321, April 1978. 45 fig, 5 tab, 17 ref.

Descriptors: *Waste water treatment, *Water reuse, *Chlorination, *Mass transfer, *pH control, *Phenols, *Gas-liquid ratio, *Gas scrubbing, *Blast furnaces, Suspended solids, Technology, Assessment, Ammonia, Alkalinity, Cyanides, Effluents, Sedimentation.

The EPA-recommended technology for treating blast furnace wastewater--essentially suspended solids removal and recirculation--was evaluated and found to be inadequate to produce effluent quality in total compliance with the 1977 limitations that include ammonia, cyanide, and phenol. Alkaline chlorination and gas-liquid mass transfer were examined for controlling the ammonia, cyanide, and phenol. The EPA-ELG was developed from a very limited data base. This evaluation examined an extensive data base consisting of responses to a questionnaire, long-term plant operating data, field survey, and literature review. (Bell-Graf--Cornell)
W79-04705

ENERGY FOR PRODUCTION OF CONSUMABLE MATERIALS,
Culp/Wesner/Culp, Santa Ana, CA.
G. M. Wesner.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE3, p 401-414, June 1978. 3 tab, 14 ref.

Descriptors: *Waste water treatment, *Water treatment, *Energy, *Energy consumption, *Chemicals, Environmental engineering, Manufacturing, Chemical plants, Consumers, Equations

Energy requirements were determined for the production of the following consumable materials used in various water and wastewater treatment operations: activated carbon, alum, ammonium hydroxide, carbon dioxide, chlorine, ferric chloride, calcium oxide, methanol, oxygen, ozone, polymers, sodium chloride, sodium hydroxide, sulfur dioxide, and sulfuric acid. Energy estimates are based on data from manufacturers, information in the technical literature and calculations. Data used in developing the energy estimates are discussed. Prec

energy requirements are difficult to determine for some materials because some manufacturing processes produce more than one product, and most chemicals are produced by more than one method. (Bell-Graff--Cornell)
W79-04713

INVESTIGATION OF THE REMOVAL OF TRACE TOXIC HEAVY METAL IONS FROM WASTE WATER BY FOAM FRACTIONATION,
Polytechnic Inst. of New York, Brooklyn. Dept. of Chemistry.
Y. Okamoto, and E. J. Chou.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 706, Price codes: A04 in paper copy, A01 in microfiche. Final Report OWRT/S--78/7, April 1978. 60 p. Also in: Separ. Sci. 741(1975); Separ. Sci. 99(1976); J. Water Poll. Cont. 2447(1976); and Separ. Sci. 439(1978). OWRT 14-30-3299.

Descriptors: *Foam separation, *Foam fractionation, *Surfactants, *Waste water treatment, *Chelation, Copper, *Heavy metals, *Trace elements, Metabolic ions, Surface tension, Chelating constant, *Separation coefficient.

The experimental work on the removal of a trace amount of metallic ions such as beryllium, cadmium, lead, mercury, copper and nickel from aqueous solution by a foam separation technique using chelating surfactants was investigated. Surfactants containing polyamine such as 4-dodecyldiethylene triamine were used as selective chelate surfactants. These ions could be removed quantitatively using a selected surfactant. These surfactants chelated with metallic ions which were found to be concentrated in the foam. The foam was removed from the liquid, and the surfactant was regenerated and recycled by the decomposition of the surfactant-metal ion complexes with Na2S and H2S. Those metal ions were precipitated as the metal sulfides and the regenerated surfactant was recycled. To establish the feasibility of using foam separation for the separation of a particular ion from one or more ions having similar charge, a selectivity coefficient was determined. The selectivity coefficient was found to be a function of surface tension of complexes and chelation constant of chelating surfactant with metallic ion.
W79-04754

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER CONVEYANCE SYSTEMS: 1973-1977.
Dames and Moore, Denver, CO.
For primary bibliographic entry see Field 6B.
W79-04761

AMMONIA TOXICITY AND PH CONTROL IN FISH TOXICITY BIOASSAYS OF TREATED WASTEWATERS,
Los Angeles County Sanitation Districts, Whittier, CA. San Jose Creek Water Quality Lab.
For primary bibliographic entry see Field 5C.
W79-04817

LAKE NEMATODE POPULATION INCREASE FOLLOWING BYPASS OF SECONDARY EFFLUENT,
Cornell Univ. Ithaca, NY. Dept. of Natural Resources.
For primary bibliographic entry see Field 5C.
W79-04818

ANNUAL CYCLES OF SOME CLADOCERANS IN A POLLUTED STREAM,
Baghdad Univ. (Iraq). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-04820

CYCLOMORPHOSIS IN DAPHNIA CARINATA KING (CRUSTACEA: CLADOCERA) FROM TWO ADJACENT SEWAGE LAGOONS IN SOUTH AUSTRALIA,
Adelaide Univ. (Australia). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-04821

ACCUMULATION OF HEAVY METALS BY THE MARINE DIATOM DITYLUM BRIGHTWELLII (WEST) GRUNOW,
Melbourne Univ., Parkville (Australia). School of Botany.
For primary bibliographic entry see Field 5C.
W79-04822

BIOLOGICAL CONTROL OF DISSOLVED ALUMINUM IN SEAWATER: EXPERIMENTAL EVIDENCE,
Northwestern Univ., Evanston, IL. Dept. of Geological Sciences.
M. Stoffyn.
Science, Vol. 203, p 651-653, 1979. 2 fig, 13 ref.

Descriptors: *Aluminum, *Diatoms, *Growth rates, Marine algae, Water chemistry, Chemical analysis, Sea water, Metals, Cytological studies, Metabolism, Adsorption, Phytoplanton, *Skeletonema.

Experimental evidence supports the hypothesis that the concentration and distribution of dissolved aluminum in ocean water are controlled by biological activity in the surface waters. The growth of the diatom Skeletonema costatum in artificial seawater media spiked with aluminum reduced the aluminum concentration to that actually found in surface open ocean waters (about 0.5 micrograms per liter). Furthermore, aluminum had a catalytic and limiting effect on the growth of the diatoms. (Deal-EIS)
W79-04824

UPGRADING FACULATIVE WASTEWATER LAGOONS WITH VASCULAR AQUATIC PLANTS,
National Space Technology Labs., NSTL Station, MS.
B. C. Wolverton, and R. C. McDonald.
Journal of the Water Pollution Control Federation, Vol. 51, p. 305-313, 1979. 2 fig, 5 tab, 24 ref.

Descriptors: *Wastewater treatment, *Sewage lagoons, Plant populations, *Aquatic plants, Sewage treatment, Water hyacinth, Biochemical oxygen demand, Algae, Nitrogen, Domestic wastes, Phosphorus, Nutrients, Seasonal, Dissolved oxygen, Mosquitoes, *Duckweed, *Gambusia.

The performance of a single-cell, facultative wastewater lagoon has been significantly improved with the introduction of vascular aquatic plants. Water hyacinth (Eichbornia crassipes) was the dominant plant from April to November; duckweek (Lemna and Spirodela spp.) flourished from December to March. This 2-ha lagoon received approximately 475 m3/d of untreated wastewater and had a 5-day biochemical oxygen demand loading rate of 22 to 30 kg/ha.d. During the first 14 months of operation with aquatic plants, the average influent 5-day biochemical oxygen demand was reduced by 95% from 110 mg/l to an average of 5 mg/l in the effluent. The average influent suspended solids were reduced by 90% from 97 mg/l to 10 mg/l in the effluent. (Deal-EIS)
W79-04830

FUNDAMENTAL RESEARCH NEEDS FOR WATER AND WASTEWATER TREATMENT SYSTEMS,
Proceedings of a conference held at Arlington, VA, December 15, 1977 sponsored by the National Science Foundation and organized by the Association of Environmental Engineering Professors, J. H. Sherrard, Editor 111 p.

Descriptors: *Wastewater treatment, *Municipal wastes, *Water pollution, Effluents, *Sludge treatment, *Sludge disposal, *Research priorities, *Research needs, Water resources, Water resources development, Planning, Environmental engineering, Water treatment, Chemical treatment.

This report is a compilation of papers presented at a conference of which the primary objectives were (1) to provide a forum and focal point for the exchange of information on fundmental research needs between the academic community, users of research, and granting agencies; (2) to define and establish priorities for these research needs; and (3) to disseminate the conference proceedings for the purpose of stimulating research in high priority areas. The conference addressed fundamental research needs which have been ignored by government funding sources in their effort to construct wastewater treatment plants. Major research topics include: fundamental research needs as seen by the user of research; congressional perspective on research needs; fundamental research needs in wastewater treatment; fundamental research needs for evaluating the interactions of treatment plants with aqueous systems; and fundamental research needs for evaluating the interactions of treatment plants with ultimate sludge disposal systems. After presentation of papers in each area, a short summary of discussion comments by other participants in the Conference is offered. (Coan--NC)
W79-04852

PURIFYING OIL SHALE RETORT WATER,
University of Southern California, Los Angeles. (Assignee).
T. F. Yen, and J. E. Findley.
U.S. Patent No. 4,124,501, 6 p, 1 fig, 1 tab, 16 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 236, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water quality control, Oil shales, Anaerobic bacteria, Sulfur bacteria, Flocculation, Industrial water, Sulfide, Sulfates, Aerobic bacteria.

A major waste product from oil shale retorting processes is water co-produced with the shale oil and which can also include a small amount of water originally trapped within the matrix of the oil shale. Although water is produced as a result of retorting of the oil shale, in the production of oil from oil shale, a great deal of water is in fact used. It would therefore be desirable to be able to utilize water formed from retorting for these production processes. However, the oil shale retort water is loaded with considerable quantities of soluble organic and inorganic materials not only preventing its utilization for production purposes, but also presenting a serious major disposable problem. This invention provides a process for purifying the oil shale retort water which has organic and inorganic components including sulfate, to enable the growth of anaerobic bacteria. Such bacteria, exemplified by the Desulfovibrio family, is added to the retort water so as to produce in the water a growth of cell biomass of the bacteria while simultaneously reducing sulfate ions to sulfide. Production of cell biomass should proceed substantially in the absence of air, preferably following purging with carbon dioxide, nitrogen to establish aerobiasis. The cell biomass is aggregated into a flocculuent mass and is removed. The sulfide is oxidized to sulfate either through combustion processes or by conversion with air and aerobic bacteria, such as of the Thiobacillus family. At least a portion of the sulfate thus produced can be recycled to the retort water so as to neutralize it prior to bacterial growth. The effluent discharge yields a water quality which not only reduces environmental damage, but also supplements industrial water requirements. (Sinha-OEIS)
W79-04883

SEWAGE TREATMENT SYSTEM,
FMC Corp., San Jose, CA. (Assignee).
M. F. Hobbs, and A. C. Green.
U.S. Patent No. 4,124,499, 11 p, 6 fig, 20 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 235-236, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution control, Chemicals, Ships, Suspended solids.

A method is provided for rapidly producing a treated waste mixture separable into a disposable mass of solids and a hygenic effluent of relatively low coliform count. The method of treating aqueous mediums involves steps in which a mixture of aqueous medium and four chemical additives, plus, if desired, a pH control agent, are established as a mixture in a holding zone. The solids of the mixture have a particle size resulting from recirculation between the holding zone and a zone adapted to effect coarse disintegration of any solids exceeding a predetermined size. The mixture is passed through an airtight liquid flow system under conditions to maintain solids in suspension and then separating the liquid portion from the solids for disposal as a hygenic effluent. The additives are a bactericidal agent, a colloidal solids coagulating agent, a filter aid and an adsorbent. (Sinha-OEIS)
W79-04886

APPARATUS FOR TREATING SEWAGE,
J. L. Ramer.
U.S. Patent No. 4,124,481, 5 p, 2 fig, 12 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 230, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Aerobic conditions, Electrolysis, Anodes, Cathodes, Mixing, Aerobic bacteria, Equipment.

There is provided a method and apparatus for treating sewage, by first comminuting raw sewage in a comminuting compartment to provide a slurry and then digesting the raw, comminuted sewage by oxygen-dependent bacteria in a roofed compartment. Oxygen is supplied by electrolysis of the water in the sewage, utilizing spaced anode and cathode. The anode is located in the roofed digestion compartment, and the oxygen generated at the anode is used by the bacteria; the cathode is located in a chimney which extends through the roof or top of the plant, to atmosphere, and the hydrogen generated at the cathode is discharged to atmosphere through this chimney. A stirrer is provided in the digestion compartment to stir trapped oxygen back into the mass of sludge. A trapping or sedimentation compartment is provided after the digestion compartment, for settling out indigestible solids, and drawing off the remaining liquid. (Sinha-OEIS)
W79-04888

PROCESS FOR TREATING CAUSTIC WASH SOLUTIONS,
G. Munden.
U.S. Patent No. 4,124,504, 5 p, 4 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 237, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution control, *Water reuse, Chemical reactions, Flocculation, Chemical precipitation, *Caustic wash solutions, Regeneration, Permanganate ions.

A process is provided for an effective means to remove contaminants from a caustic wash solution used in cleaning metal articles. The contaminants can be classified into three broad categories, e.g. saturates, olefins, and aromatics which represent about 25 to 30% by weight of the total contamination. The caustic wash solutions are regenerated in an efficient, relatively inexpensive manner by means of chemical purification using permanganate ions. It appears that the permanganate oxidizes the organic contaminants of the wash solution by generally attacking at a double bond junction. This then effects reduction of the organic compounds to tar residues which tend to adhere onto the surface of the manganese dioxide and improve the flocing efficiency. Another characteristic of precipitation of the manganese dioxide is that it initiates coprecipitation. After separation of the flocs, the solution is suitable to be reused as a wash solution thus eliminating disposal problems and adverse ecological and environmental effects. (Sinha-OEIS)
W79-04889

PROCESS FOR THE PURIFICATION OF GREASY AND SOILED WATER USING A HEAVY SOLVENT, AND APPARATUS FOR ITS IMPLEMENTATION,
Peignage Amedee, Roubaix (France). (Assignee).
B. J. O. Leman.
U.S. Patent No. 4,124,502, 7 p, 2 fig, 16 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 236, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Organic wastes, Solvents, Solvent extraction, Separation techniques, Recycling, Distillation, Equipment, Wool industry, Grease.

A process for the purification of waste water containing grease and soil, especially the effluent from wool-soaking and wool-washing, comprises mixing the waste water with a heavy solvent. The emulsion formed obtains degreased water, a small quantity of water-solvent emulsion, and solvent charged with greasy matter and soil. This solvent is clarified to separate the soil and is subjected to an azeotropic distillation in the presence of water to form an emulsion from which the greasy matter can be recovered, and a head product from which the solvent can be regenerated. (Sinha-OEIS)
W79-04890

DEGRADATION OF ORGANIC COMPOUNDS IN EFFLUENTS BY WET OXIDATION,
Farbenfabriken Bayer A.G., Leverkusen (Germany, F.R.). (Assignee).
O. Horak, H. Alles, W. Hortmann, K. Hammerstrom, and R. Potthast.
U.S. Patent No. 4,124,505, 4 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 237, November 7, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Organic wastes, Water pollution treatment, Oxidation, Oxygen-reduction potential, Electrolysis.

The object is to obviate the disadvantages attending the conventional wet oxidation process and in particular to enable wet oxidation of the organic substances present in the effluent to be carried out at lower temperatures and pressures. The oxidation is effected at a recos potential of from about 300 to 600 millivolts, as measured with a platinum electrode against a silver-silver chloride electrode, at a temperature of from about 80 to 250C and under a pressure of from about 30 to 200 bars. The redox potential may be maintained by an Fe2+ and/or Fe3+ ion system and the pH is advantageously below about 7. (Sinha-OEIS)
W79-04892

APPARATUS AND METHOD FOR TREATING WASTE-CONTAINING LIQUORS,
Research Corp., New York. (Assignee).
H. Hagiwara.
U.S. Patent No. 4,126,545, 8 p, 5 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 935-936, November 21, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Organic wastes, Biological treatment, Bacteria, Filtration, Equipment.

Waste containing liquor is treated in a device containing submerged, slowly rotating bacterial growth surfaces which are spaced apart from each other, extend in a horizontal plane and are mounted on a vertical, rotating shaft. The bacterial growth surfaces, which may be in the configuration of a substantially flat disk, are maintained submerged in a waste water treatment tank as the waste-containing liquor is passed over, through and around them. The tank may be provided with several sets of growth areas and shafts which are interleafed and separated from each other. (Sinha-OEIS)
W79-04893

PROCESS AND APPARATUS FOR REMOVING IMPURITIES DISSOLVED IN WATER,
Nat. Ulrich Baensch G.m.b.H., Melle (Germany, F.R.). Tetra Werke. (Assignee).
U. Baensch, and L. Benedetto-Castro.
U.S. Patent No. 4,126,544, 9 p, 7 fig, 16 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 935, November 21, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water purification, Biological treatment, Nitrates, Nitrogen compounds, Ammonia, Anaerobic conditions, Nitrification, Equipment.

A process and apparatus is described for removing impurities dissolved in water such as organic nitrogen compounds, nitrates, nitrites and ammonium compounds. Biological processes are utilized comprising the steps of passing the water to be purified in the presence of a normal atmosphere, is downwardly flowing manner through a system which ensures ammonification and nitrification. Then the water is passed, in the presence of a nitrogen atmosphere, through a system which physically expels oxygen, then passing the water once again in the presence of a nitrogen atmosphere through a system which biologically reduces nitrates, and finally after draining off the gases formed from the impurities, removing purified water. (Sinha-OEIS)
W79-04894

ION EXCHANGE PROCESS,
Asahi Kasei Kogyo Kabushiki Kaisha, Osaka (Japan). (Assignee).
T. Misumi, T. Miyaji, and M. Kasai.
U.S. Patent No. 4,126,548, 6 p, 6 fig, 2 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 936-937, November 21, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Ion exchange, Resins, Adsorption, Equipment, Regeneration, Backwashing.

A countercurrent fixed-bed ion exchange process for treatment of a fluid comprises passing a fluid to be treated through a treatment zone packed with ion exchange resin particles in one direction, regenerating the ion exchange resin particles on depletion in activity by passing a solution of regenerant in opposite direction and subjecting the contaminated ion exchange resin particles to a backwash treatment in a backwashing zone which is provided separately from the treatment zone. The backwash treatment is conducted by removing portionwise, either continuously or intermittently the contaminated resins from an outlet provided at one side of the treatment zone, and transporting them to the backwashing zone. They are then returned portionwise, either continuously or intermittently, to the treatment zone through an inlet provided at the opposite side until the while ion exchange resins particles are replaced.(Sinha-OEIS)
W79-04895

FLASH REACTOR,
C. Doerschiag.
U.S. Patent No. 4,126,550, 5 p, 3 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 937, November 21, 1978.

Descriptors: *Patents, *Waste water treatment, *Water quality control, Neutralization, Hydrogen ion concentration, Acid-base equilibrium, Oxidation, Flocculation, Instrumentation, Equipment.

The amount of acidity, alkalinity, or other ion imbalance in the waste stream must be measured and treated to assure proper neutralization and destruction or conversion of harmful ion concentrations so that waste water discharges are environmentally acceptable and harmless to aquatic life and to other subsequent users of the water. To assure a reliable and thorough treatment appropriate sensing and control loop instrumentation is provided which must be capable of indicating the stream concentration parameters and responding with signals to correct any deviation from an established set point. The apparatus is described for treating waste liquid streams by neutralization, ox

dation, or flocculation. Waste liquid and a treating substance, such as an acid or a base, are introduced through a nozzle into a chamber. The rate of addition of treating substance is controlled by deviations from a set point. This invention improves the performance of a conventional continuous treatment system by minimizing the reaction zone with a reduced mixing chamber and by providing rapid response to changes in entering waste liquid quality through a minimum of dead time. (Sinha-OEIS)
W79-04896

PHOSPHATE REMOVAL USING WASTE CALCIUM SULFATE,
Notre Dame Univ., IN. Dept. of Civil Engineering.
T. L. Theis, and G. A. Fromm.
Journal of the Environmental Engineering Division, Vol. 103, No. EE5, p 951-955, October, 1977. 4 fig, 8 ref, append.

Descriptors: *Phosphates, *Calcium sulfate, Water pollution, Water quality, Water quality control, Waste water, Waste water treatment, Sulfates, *Gypsum.

Calcium sulfate (gypsum) is a common mineral which is among the cheapest sources of soluble calcium ion available. Relatively pure calcium sulfate is produced as a byproduct in several industries including chemical, pharmaceutical, and, in the near future, also by high sulfur coal-fired utilities which must remove stack gas SO2. Thus, on a local basis it may be obtained at a markedly reduced cost, transportation being a major cost factor. This study was undertaken to explore the possibility of employing gypsum as a supplemental chemical for the removal of phosphate from wastewaters, and to determine under what conditions it can be utilized. The data suggest that the use of calcium sulfate as a supplemental source of calcium ion for phosphate removal may be a feasible alternative to other processes which use lime alone. Cost savings result from the lower amounts of lime needed and from the fact that there is no need to neutralize the alkaline effluent. (Skoger-Boe-Colorado State)
W79-04977

5E. Ultimate Disposal Of Wastes

OIL SHALE AND THE ENVIRONMENT,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6B.
W79-04522

ENGINEERING AND ECONOMIC ANALYSIS OF WASTE TO ENERGY SYSTEMS,
Parson (Ralph M.) Co., Pasadena, CA.
For primary bibliographic entry see Field 6B.
W79-04526

POLLUTION CONTROL GUIDANCE FOR GEOTHERMAL ENERGY DEVELOPMENT,
Industrial Environmental Research Lab., Cincinati, OH.
For primary bibliographic entry see Field 5C.
W79-04530

THE UPTAKE AND RELEASE OF PETROLEUM HYDROCARBONS BY THE MARINE MUSSEL MYTILUS EDULIS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
For primary bibliographic entry see Field 5A.
W79-04588

WASTE INJECTION INTO A TWO-PHASE FLOW FIELD: SAND-BOX AND HELE-SHAW MODELS STUDY,
Hawaii Univ., Honolulu. Dept. of Geology and Geophysics.
J. L. Peterson, J. A. Williams, and S. W. Wheatcraft.
Ground Water, Vol. 16, No. 6, p 410-416, November-December 1978. 9 fig, 5 ref. OWRT-B-043-HI(3), OWRT-A-071-HI(2).

Descriptors: *Injection wells, *Path of pollutants, *Waste water disposal, *Model studies, Laboratory tests, Groundwater, Groundwater movement, Density, Salinity, Saline water-freshwater interfaces, Pollutants, Effluents, Water pollution, Water pollution sources, Dispersion, Buoyancy, Plumes, Effluent plumes, Buoyant plumes.

Sandbox and Hele-Shaw models were used to study waste water injection into two-phase groundwater bodies. Two types of experiments were conducted: 'static' experiments in which there was no movement of the fresh groundwater body with respect to the underlying salt water prior to waste injection, and 'dynamic' experiments in which a fresh groundwater flow field was present prior to and during waste injection. During every experiment, buoyant plumes of injected effluent, which were clearly distinct from the resident aquifer liquids, formed and migrated upward into the lower portion of the freshwater body. Three injection parameters exerted significant control on the movement of the injection plumes; the rate of effluent injection and the strength of the ambient freshwater flow field significantly influence both the vertical and lateral migration of the plumes, and the depth of effluent injection (with respect to the salt/fresh-water interface) influenced the over-all shape of the plumes as well as the lateral migration of the plumes. The principal means of plume movement in these experiments appears to be by fluid displacement processes, rather than by dispersion processes. (Sims-ISWS)
W79-04599

MECHANISM OF ALUMINUM SULFATE RECOVERY FROM LIGNIN SLUDGE (MEKHANISM IZVLECHENIYA SULFAT ALYUMINIYA IZ SHLAM-LIGNINA),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
For primary bibliographic entry see Field 5D.
W79-04643

HAZARDOUS WASTES INPUT INTO CLASS I LANDFILLS,
University of Southern California, Los Angeles. Environmental Engineering Program.
B. Eichenberger, J. Edwards, K. Y. Chen, and R. Stephens.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE3, p 385-399, June 1978. 2 fig, 8 tab, 19 ref.

Descriptors: *Water pollution, *Wastes, *Waste disposal, *Metals, *Hazardous materials, Environmental engineering, Sanitary landfill, Liquid wastes, Pollutants.

This study documents 17 metal species discharged to Class I landfill sites. These sites receive a combined estimated daily volume of 2.3 x 10 to the 6th power l/day of hazardous wastes. The metal species are ranked according to their estimated daily total deposition: Na>Fe>Ca>Zn>Mg>Cu>Cr>Ni>Pb>Ba>Mn>V>As>Cd>Be>Ag. Approximately 50% of the total volume of hazardous wastes sampled were generated by the petroleum industry. About 35% of the volume was equally divided between the chemical industry and industrial cleaning. The metal, food, and miscellaneous/unknown industries each contributed less than 10% of the total volume. Approximately 70% of the total volume was in the aqueous phase and 8% consisted of an organic liquid phase. The weight percent of 17 metal species in the soluble phase ranged from less than 10% to a maximum of 90%. The volume flow and concentration of soluble toxic metals pose a potential water quality problem. (Bell-Graf--Cornell)
W79-04715

GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN PERTINENT TO THE STORAGE OF RADIOACTIVE WASTES--A PROGRESS REPORT,
Geological Survey, Baton Rouge, LA. Water Resources Div.
R. L. Hosman.
Geological Survey Water-Resources Investigations 78-104 (open-file report), November 1978. 27 p, 2 fig, 10 plates, 4 tab, 26 ref.

Descriptors: *Underground waste disposal, *Nuclear waste, *Louisiana, *Hydrogeology, *Aquifer characteristics, Radioactive waste disposal, Groundwater movement, Path of pollutants, Water quality, Surface-groundwater relationships, Evaluation, Planning, *Northern Louisiana salt-dome basin, Dissolution.

Salt domes in northern Louisiana are being considered as possible storage sites for nuclear wastes. The domes are in an area that received regional sedimentation through early Tertiary (Eocene) time with lesser amounts of Quaternary deposits. The Cretaceous-Tertiary accumulation is a few thousand feet thick; the major sands are regional aquifers that extend far beyond the boundaries of the salt-dome basin. Because of multiple aquifers, structural deformation, and variations in the hydraulic characteristics of cap rock, the groundwater hydrology around a salt dome may be highly complex. The Sparta Sand is the most productive and heavily used regional aquifer. It is either penetrated by or overlies most of the domes. A fluid entering the Sparta flow system would move toward one of the pumping centers, all at or near municipalities that pump from the Sparta. Movement could be toward surface drainage where local geologic and hydrologic conditions permit leakage to the surface or to a surficial aquifer. (Woodard-USGS)
W79-04810

LEAD ACCUMULATION IN PLANKTON BLOOMS FROM ULLSWATER, THE ENGLISH LAKE DISTRICT,
London Univ. (England). Dept. of Botany; and London Univ. (England). Dept. of Biochemistry.
For primary bibliographic entry see Field 5C.
W79-04819

ACCUMULATION OF HEAVY METALS BY THE MARINE DIATOM DITYLUM BRIGHTWELLII (WEST) GRUNOW,
Melbourne Univ., Parkville (Australia). School of Botany.
For primary bibliographic entry see Field 5C.
W79-04822

BIOLOGICAL CONTROL OF DISSOLVED ALUMINUM IN SEAWATER: EXPERIMENTAL EVIDENCE,
Northwestern Univ., Evanston, IL. Dept. of Geological Sciences.
For primary bibliographic entry see Field 5D.
W79-04824

UPGRADING FACULATIVE WASTEWATER LAGOONS WITH VASCULAR AQUATIC PLANTS,
National Space Technology Labs., NSTL Station, MS.
For primary bibliographic entry see Field 5D.
W79-04830

AN ANALYSIS OF THE FUNCTIONAL CAPABILITIES AND PERFORMANCE OF SILT CURTAINS.
JBF Scientific Corp. Wilmington, MA.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-39, July 1978. 190 p, 78 fig, 7 tab, 2 app, 15 ref.

Descriptors: *Silts, *Sediment control, Turbidity, Barriers, *Dredged material disposal, *Silt curtains.

Where current velocities are less than 0.2 ft/sec, silt curtains that are properly deployed and main-

tained can effectively control dispersion of turbid water in the upper part of the water column. Silt curtain effectiveness depends on nature of the operation, quantity and type of material in suspension, characteristics and configuration of the silt curtain, ethod of deployment and hydrodynamic conditions at the site. Under ideal conditions, turbidity levels in water column outside the curtain can be as much as 80 to 90 percent lower than those levels inside or upstream of the curtain. When silt curtains are used to enclose open-water pipeline disposal operations, 95 percent of dredged material slurry descends to the bottom of the disposal area and forms a fluid mud layer. As current velocities increase, effective depth of the silt curtain is reduced due to flare, and associated turbulence may cause significant resuspension of the fluid mud layer. Silt curtains are not designed to control accumulation of fluid mud and must be moved when fluid mud reaches the depth of the lower skirt edge to prevent burial of the curtain. Silt curtains are not recommended for use in environments where currents exceed 1.5 ft/sec. (WES)
W79-04924

DESIGN CONCEPTS FOR IN-WATER CONTAINMENT STRUCTURES FOR MARSH HABITAT DEVELOPMENT,
Coastal Engineering Research Center, Fort Belvoir, VA.
J. W. Eckert, M. L. Giles, and G. M. Smith.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-31, July 1978. 69 p, 2 app, 2 tab, 6 fig, 27 ref.

Descriptors: *Marshes, *Marsh management, Habitat improvement, Dredged material, *Dredged material disposal, *Containment structures.

Provides general guidance for structure selection and development of structure design concepts for use in habitat development. Various types of structures were reviewed, based on available literature, to determine which would be applicable to habitat use. Planning and design concepts are presented for use of the potential structure types for habitat development. References are provided for detailed design and construction guidelines. Case histories of structures used for habitat development are discussed. A list is provided of the known projects, their locations, and structural types. Few structures have been built specifically to retain or protect dredged material for purposes of habitat creation, however, the predominant structures used for habitat creation have been sand dikes. (WES)
W79-04925

CASE STUDIES AND COMPARATIVE ANALYSES OF ISSUES ASSOCIATED WITH PRODUCTIVE LAND USE AT DREDGED MATERIAL DISPOSAL SITES,
Energy Resources Co., Inc., Cambridge, MA.; and Sasaki Associates Inc., Watertown, MA.
J. J. Gushue, and K. M. Kreutziger.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-43, December 1977, in two volumes (Vol. I consists of main text and Vol. II consists of appendixes). 422 p, 19 app, 52 tab, 63 fig, 185 ref.

Descriptors: *Waste disposal, *Land use, *Project planning, *Dredged material disposal, Dredged material.

Compares and evaluates 12 selected cases where dredged material from navigation projects was used to create productive land. Results are directly applicable as a management aid for Corps disposal planners. The principal output was the development of an overall set of 'implementation factors' for disposal-productive use projects. Thirty-seven factors were identified and categorized as environmental, technical, economic/financial, legal, institutional, or planning/implementation. These factors provide a framework for ensuring that project planners address the full range of substantive and procedural considerations that are important to successful project implementation. The case studies provide documented proof disposal-productive use project success is as much affected by procedural factors as by substantive factors. Procedural aspects of each case study are fully delineated in individual case study synopses contained in Volume II of the study report. The detailed comparative analyses of the 12 cases, which led to the identification of the important implementation factors, are also provided in Volume II. The matrix approach enables the site-specific nature of disposal planning to be retained in the analysis while providing a common basis for comparison. As a result, the set of implementation factors is applicable to all disposal situations. (WES)
W79-04926

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, BOLIVAR PENINSULA MARSH AND UPLAND HABITAT DEVELOPMENT SITE, GALVESTON BAY, TEXAS; APPENDIX D: PROPAGATION OF VASCULAR PLANTS AND POST-PROPAGATION MONITORING OF BOTANICAL, SOIL, AQUATIC BIOTA, AND WILDLIFE RESOURCES,
Texas Agricultural Experiment Station, College Station.
J. W. Webb.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-15, June 1978. 772 p, 1 append, 91 fig, 162 tab, 53 ref.

Descriptors: *Habitats, *Wildlife, *Biota, *Texas, On-site investigations, Plant growth, *Dredged material disposal, Dredged material, *Galveston Bay, *Vascular plants.

A 2-1/2-year field investigation was conducted at Bolivar Peninsula to test the feasibility and impact of developing marsh and upland habitat on dredged material. This summarizes baseline information derived before habitat development operations and results of post-development operation. Two marsh grass species and nine upland plant species including trees, shrubs, and grasses were planted in test plots on a dredged material site lying between the Gulf Intracoastal Waterway and Galveston Bay. Tests were conducted to measure plant survival and performance in response to different fertilizer treatments and planting methods. Plantings of the marsh grasses were made within an intertidal area protected from wave energies by a sandbag dike. Prior to and during plant development, information was collected to document changes in fish and wildlife communities. After less than a year of development, the site provided heterogeneous habitats which tended to support greater use by fish and benthos than generally associated with sandy shores along Bolivar Peninsula. This indicated habitat development can be a feasible dredged material disposal alternative. (WES)
W79-04927

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX D: CHEMICAL AND PHYSICAL ANALYSES OF WATER AND SEDIMENT IN RELATION TO DISPOSAL OF DREDGED MATERIAL IN ELLIOTT BAY, VOL. I, FEB - JUNE 1976,
Corvallis Environmental Research Lab., OR. Marine and Freshwater Ecology Branch.
For primary bibliographic entry see Field 5C.
W79-04928

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX D: CHEMICAL AND PHYSICAL ANALYSES OF WATER AND SEDIMENT IN RELATION TO DISPOSAL OF DREDGED MATERIAL IN ELLIOTT BAY; VOL. II: SEPT.-DEC. 1976,
Washington Univ., Seattle. Lab. of Radiation Ecology.
For primary bibliographic entry see Field 5B.
W79-04929

NEEDS AND AREAS OF POTENTIAL APPLICATION OF DISPOSAL AREA REUSE MANAGEMENT (DARM),
Army Engineer Waterways Experiment Station, Vicksburg, MS
M. R. Palermo.
Technical Report D-78-27, June 1978. 46 p, 11 fig, 27 ref, 2 tab.

Descriptors: Disposal Area Reuse Management(DARM), Dredged material, *Dredged material disposal.

Documents the results of a survey of Corps of Engineers (CE) Districts for needs and areas of potential application of Disposal Area Reuse Management (DARM). Under the DARM concept, disposal areas are regarded as collection and processing sites where dredged material is rehandled within the site or totally removed, thereby increasing or restoring site capacity for subsequent disposal. A total of nine CE Districts were surveyed regarding DARM. Critical shortages of confined disposal capacity was found to exist in many areas throughout the country. However, Districts are generally reluctant to restore sites through DARM where provision of disposal sites is the sole responsibility of the local sponsor. Acquiring additional disposal sites is considered the most economical solution to shortages of capacity. Where responsibility for providing disposal sites lies with the government, DARM is considered an alternative to acquiring additional sites, provided technical constraints can be resolved and economic feasibility determined. Technical feasibility of full-scale application of DARM is demonstrated by the success of ongoing programs in the Philadelphia and Sacramento Districts. In areas where fine-grained material predominates, technical constraints concerning dewatering, removal, and transport must be resolved before DARM concepts may be implemented on a large scale. (WES)
W79-04930

VERTICAL MIGRATION OF BENTHOS IN SIMULATED DREDGED MATERIAL OVERBURDENS; VOL. I: MARINE BENTHOS,
Delaware Univ., Lewes. Marine Studies Complex
D. L. Maurer.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-35, June 1978. 108 p, 29 tab, 63 ref, 1 fig, 1 append

Descriptors: *Environmental effects, *Benthos, *Vertical migration, *Dredged material disposal, *Waste disposal sites, Dredged material.

Determines effect of simulated dredged material disposal on vertical migration ability and survival of benthic invertebrates. Many species tested showed a surprising ability to vertically migrate and survive in relatively thick deposits of native and exotic sediments. Since surface water chemistry appeared more conducive to the survival of benthic organisms than pore water chemistry, the organisms may have needed to reestablish direct or indirect contact with the surface waters via siphons, or tubes through dredged material overburden. Assuming worst-case laboratory conditions, vertical migration may be an important factor in the recovery of benthic communities in dredged material disposal areas. Mortalities generally increased with increased sedimet depth, with increased burial time, and with overlying sediments whose particle size distribution differed from that of the animals' preferred habitat. Temperature affected mortalities under certain conditions, but percent migration was more responsive than mortality to temperataure. In addition, mortality and percent migration were influenced by synergistic effects of experimental variables. Because physiological conditions of animals differ, caution should be used when applying these results to other areas and animals with morphology similar to those tested. However, the morphological and habitat approach can be used to develop a dependable method for prediction. (WES)
W79-04931

A METHODOLOGY FOR DETERMINING LAND VALUE AND ASSOCIATED BENEFITS CREATED FROM DREDGED MATERIAL CONTAINMENT,
SCS Engineers, Reston, VA.
E. T. Conrad, and A. J. Pack.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-19, June 1978. 116 p, 15 append, 12 tab, 2 fig.

Descriptors: *Land, *Evaluation, *Value, *Containment areas, *Dredged material, *Waste disposal sites.

Presents a step-by-step methodology for determining land values and associated benefits from the productive use of dredged material containment sites. A discussion of productive uses of dredged material sites, their physical characteristics, institutional and legal constraints, and local land demand is included, as well as an overview of property valuation. Site description, establishment of use potential, value estimation, and associated benefits and impacts are discussed. Working tables are presented. The resulting land value and the associated benefits and impacts created by dredged material containment should be explicit inputs to the formulation of plans in according with Principles and Standards for Water and Related Resource Planning and Corps of Engineers regulations. Fifteen case studies of productively used dredged material containment sites were conducted to validate and refine the methodology. One of the case studies was used in this report as a site-specific example of how methodology can be applied. All fifteen case studies are included as Appendices A through O. (WES).
W79-04933

DEVELOPMENT OF PROCEDURES FOR SELECTING AND DESIGNING REUSABLE DREDGED MATERIAL DISPOSAL SITES,
Acres American Inc., Buffalo, NY.
T. E. Raster, D. C. Steuernagel, H. S. Gill, and D. J. Lipiro.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-22, June 1978. 339 p, 3 append, 86 fig, 32 tab, 44 ref.

Descriptors: *Environmental effects, *Dredged material disposal, *Waste disposal sites.

Presents a logical, step-by-step methodology for site selection and design of reusable dredged material disposal sites. The methodology is capable of handling anything from a single disposal site serving a sinlge dredging location to an entire dredging program involving several dredging locations and disposal sites. Pertinent factors--legal, enivronmental, and technological--which influence selection of candidate disposal sites and determine their suitability as reusable and nonreusable sites are identified. Site design and operating recommendations are presented, along with a preliminary costing procedure to enable evaluation of alternative disposal options for each site and cost modifications of the entire dredging program. Numerical examples are provided to assist the reader in applying the procedures to his particular case. Although this report promotes reusable disposal sites, nonreusable sites of a nonconventional nature are also discussed for situations where reusable sites are inappropriate or economically unsound. (WES)
W79-04934

5F. Water Treatment and Quality Alteration

ION-EXCHANGE PRETREATMENT OF WATER AFTER RESIN REGENERATION WITH REVERSE OSMOSIS REJECT BRINE,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. J. Eisenhauer, and R. W. Schiller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 972, Price codes: A02 in paper copy, A01 in microfiche. Report No. REC-ERC-77-15, April 1977. 20 p, 5 fig, 8 tab, 4 ref.

Descriptors: *Ion exchange, *Water treatment, *Pre-treatment(Water), Separation techniques, Desalination, Electrodialysis, Reverse osmosis, Membrane processes, LaVerkin Springs(Utah), Water quality, Calcium, Sulfates.

Calcium must be removed from the feed water for electrodialysis (ED) and reverse osmosis (RO) desalting processes to prevent membrane fouling by calcium sulfate. Pretreatment using the ion exchange (IX) method entails a continuous cycling, one process unit operation with low operating and capital costs. Water imported from LaVerkin Springs, Utah, was tested at the Bureau Testing Desalinization Test Station, Longmont, Colorado, using the IX pretreatment method. The calcium in the raw LaVerkin Springs (LVS) water was reduced below sulfate fouling concentration by IX, desalting was accomplished by RO, and the recovered reject brine was used for regenerating the spent IX resin. Test results show that IX pretreatment of LVS water can be operated as a closed-loop exhaustion-regeneration cycle, and only the reject brine from RO need be used to regenerate the IX resin. (Davison-IPA)
W79-04505

A PILOT PLANT STUDY TO PROVIDE IMPROVED QUALITY FEED WATER FOR THE WEBSTER, SOUTH DAKOTA ELECTRODIALYSIS PLANT,
Johns-Manville Research and Engineering Center, Manville, NJ.
G. R. Bell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-178 522, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 201, August 1966. 34 p, 12 fig, 6 tab, 1 append. 14-01-0001-616.

Descriptors: *Water treatment, *Water quality control, *Membrane, *Pilot plants, Pretreatment(Water), Waste treatment, Electrodialysis, Iron, Manganese, Organic matter, Silica, Filtration, Water purification, Design criteria, Webster(South Dakota).

A pilot plant study was undertaken when analysis of published reports indicated that slippage of unremoved iron and manganese in treated well water supplied to the Webster, South Dakota, electrodialysis plant could adversely affect the electrical and dialytic properties of the membranes. Silica and organic matter also appeared to contribute to the membrane problems. The specific objectives of the program included the removal of iron by the fiber aid-MgO process demonstration, removal of manganese by the use of filter aid and KMnO4 demonstration, determination of the extent of silica removal, and determination of the extent of organic matter removal using filter aid filtration and granular activated carbon clean up. A treatment system providing improved quality feed water to the electrodialysis plant was developed in which very low levels of iron and manganese were attained and organic matter was greatly reduced; silica was not appreciably reduced. Parameters were developed for the design of a full sized pretreatment unit and operating costs, except for granular activated carbon, were estimated. (Davison-IPA)
W79-04510

ESTIMATING COSTS FOR WATER TREATMENT AS A FUNCTION OF SIZE AND TREATMENT PLANT EFFICIENCY,
Culp, Wesner, Culp, Santa Ana, CA.
For primary bibliographic entry see Field 6B.
W79-04527

CHEMICAL PRECIPITATION-COAGULATION FOR ORGANIC COLOR REMOVAL FROM GROUNDWATERS,
Mississippi State Univ., Mississippi State.
J. E. Bowie, Jr., and M. T. Bond.
Water Resources Bulletin, Vol. 13, No. 6, p 1269-1280, December 1977. 6 fig, 3 tab, 4 ref. OWRT-A-084-MISS(4), 14-31-0001-5024.

Descriptors: *Organic compounds, *Chemical precipitation, *Chemical treatment system, Coagulation, *Groundwater, Wells, Mississippi, Sampling, Alum, Polyelectrolyte, Rapid mix, Flocculation, Jar tests.

Many wells produce water that is highly colored by organic substances. Colored water may cause aesthetic, economic, and health problems for the cities using it as a municipal supply. Characterization of water from a number of wells showed that the color causing compounds were hydroxylated aromatic carboxylic acids which were precipitated below pH 4.5 and were almost completely ionized above pH 4.5. Through jar tests, a chemical precipitation-coagulation treatment system was developed. The optimal sequence of chemical addition was alum first, followed by pH adjustment and addition of polyelectrolyte. Rapid mix tests demonstrated (1) need for a reaction period after alum and after acid addition, (2) that the rapid mix time controlled flox size for a given flocculation period. Flocculation tests, varying both the floc time and mean velocity gradient, G, showed that an optimum G exists for each floc time and that the residual color decreased with decreasing values of velocity gradient. (Graf-Cornell)
W79-04614

REDUCTION OF AQUEOUS HOCL WITH ACTIVATED CARBON,
Georgia Inst. of Tech., Atlanta. Dept. Civil Engineering.
M. T. Suidan, V. L. Snoeyink, and R. A. Schmitz.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. EE4, p 677-691, August 1977. 5 fig, 14 ref, 3 append. OWRT A-066-ILL(2), 14-31-0001-5013.

Descriptors: *Simulation analysis, *Activated carbon, *Chlorine, Aqueous solutions, Mathematical models, Chemical reactors, Transport phenomena, Sanitary engineering.

A mathematical model describing the unsteady state of chlorine removal from water by activated carbon is developed and tested. Constants in the model, which account for intraparticle diffusion and surface reaction, are determined from semi-batch experiments in which the level of free chlorine, present in all cases as HOCl, is maintained constant. The resulting model is tested for its adequacy in describing experimental results obtained from a closed batch reactor in and from a fixed-bed reactor for several sets of conditions including different particle sizes. Very close agreement is demonstrated between experimental results (in the form of effluent chlorine concentration versus time) model predictions. (Graf-Cornell)
W79-04615

ENERGY FOR PRODUCTION OF CONSUMABLE MATERIALS,
Culp/Wesner/Culp, Santa Ana, CA.
For primary bibliographic entry see Field 5D.
W79-04713

SOLUTION OF GRANULAR BED FILTRATION EQUATIONS,
Ministry of the Interior, Jerusalem (Israel). Water Quality.
A. Adin.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE3, p 471-484, June 1978. 5 fig, 16 ref.

Descriptors: *Water treatment, *Filters, *Environmental engineering, *Filtration, *Mathematics, Bed forms, *Granular media, Adsorption, Computers, Numerical techniques, Optimizaton, Prediction, Mathematical models, Equations, Systems analysis.

Mathematical models based on filtration theory may play an important role in pilot plant studies of granular bed filtration. A semianalytical solution of such a model is presented, solving the material balance and the kinetic equations to provide con-

centration, specific deposit and gradient variations with filtrate volume and bed depth. A transformation of the filtration equations yields a quasilinear hyperbolic partial differential equation which is solved numerically using the 'method of characteristics.' The method, the numerical analysis and the computer program are explained in detail. The solution enables the use of filtration equations to predict filter performance and optimize design by feeding the computer with the filtration parameters obtained by pilot experiments. It is also applicable to other accumulation processes, i.e., fixed-bed adsorption, which have a similar conservation equation. (Bell-Graf--Cornell)
W79-04716

SOCIAL AND ECONOMIC ASPECTS OF WATER EXPLOITATION,
For primary bibliographic entry see Field 6B.
W79-04760

PROCESS FOR THE SEQUESTRATION OF OXYGEN DISSOLVED IN WATER AND COMPOSITIONS USEFUL FOR SUCH PURPOSE,
Etablissements Kuhlmann, Paris (France). Produits Chimiques. (Assignee).
B. Arghiropoulos, and A. P. N. Tignol.
U.S. Patent No. 4,124,500, 3 p, 2 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 1, p 236, November 7, 1978.

Descriptors: *Patents, *Water treatment, *Industrial water, Oxygen, Chemical reactions, Water quality, Boiler water.

A process is disclosed for eliminating oxygen dissolved in water. A hydrazine solution containing an activator is added to the water. The role of such compounds is merely to increase the reaction speed of the hydrazine with respect to such oxygen, and the amount of such compounds used is much less than the amount of oxygen to be eliminated and, also, much less than the amount of hydrazine employed. These solutions are usually used in the present treatment of boiler waters. (Sinha-OEIS)
W79-04884

TREATMENT OF WATER,
CIBA-GEIGY Ltd., London (England). (Assignee).
T. I. Jones, G. Graham, and M. A. Finan.
U.S. Patent No. 4,126,549, 10 p, 1 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 937, November 21, 1978.

Descriptors: *Patents, *Water treatment, *Industrial water, *Water softening, Scaling, Corrosion, Alkaline earth metals, Polymers.

A method of prevention of scale and the inhibition of corrosion in aqueous systems consists of the use of low molecular weight hydrolyzed terpolymer of maleic anhydride with two other ethyl-enically unsaturated monomers, preferably vinyl acetate and ethyl acrylate. The use of such terpolymers at very low concentrations in water prevents the build-up of alkaline earth sulphates as well as carbonates in heat transfer equipment, boilers, oil well drilling operations and the like. (Sinha-OEIS)
W79-04885

5G. Water Quality Control

ECONOMIC AND ENERGY ANALYSES OF REGIONAL WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W79-04523

NITRATE AND PHOSPHORUS RUNOFF LOSSES FROM SMALL WATERSHEDS IN GREAT LAKES BASIN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5C.
W79-04535

EFFECTS OF DIVERSION AND ALUM APPLICATION ON TWO EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-04536

NITRATES IN WATER SUPPLY ABSTRACTIONS IN THE ANGLIAN REGION: CURRENT TRENDS AND REMEDIES UNDER INVESTIGATION,
Anglian Water Authority (England). Public Health and Water Supplies.
For primary bibliographic entry see Field 5A.
W79-04570

THE APPLICATION OF OPTIMAL LINEAR REGULATOR THEORY TO A PROBLEM IN WATER POLLUTION,
Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 7B.
W79-04596

WATER-CONSERVATION METHODS TO MEET PENNSYLVANIA'S WATER NEEDS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 3D.
W79-04598

SIMULATION OF URBAN NON-POINT SOURCE POLLUTION,
CH2M/Hill, Redding, CA.
For primary bibliographic entry see Field 5B.
W79-04609

AGRICULTURE AND SALINITY,
B. D. Gardner, and C. E. Stewart.
In: Values and Choices in the Development of The Colorado River Basin, The University of Arizona Press, Tucson, Arizona, 1978, p 121-143. 7 fig, 4 tab, 14 ref.

Descriptors: *Colorado River, Colorado River Basin, *Return flow, Water pollution control, Water pollution sources, Salinity, Mexican water treaty.

This paper discusses the saline return flow problems of the Colorado River due to irrigated agriculture of the Colorado River Basin. (Skogerboe-Colorado State)
W79-04659

INTERNATIONAL PROBLEMS,
For primary bibliographic entry see Field 6E.
W79-04660

FUNDAMENTAL RESEARCH NEEDS FOR WATER AND WASTEWATER TREATMENT SYSTEMS,
For primary bibliographic entry see Field 5D.
W79-04852

WATER MANAGEMENT POLICIES AND INSTRUMENT.
Organization for Economic Co-Operation and Development, Paris (France).
1977, 157 p.

Descriptors: *Water policy, *Water management(Administrative), *Water management instruments, *Institutions, *Water resources management, Social aspects, Economic efficiency, Pollution charges, Water technology, Water quality, Water pollution control, Water quantity, Effluent discharge, Water use, Canada, Finland, France, Germany, Japan, The Netherlands, United Kingdom, United States, Economic instruments, Legal instruments, Regulation, Economics.

This report is a follow-up to 8 OECD Member country monographs on economic and policy instruments for water management. The major purposes of the study are: to provide information on water management instruments; to see how impacts and results of using these instruments can be assessed; to place water policy in a general social, political, economic and technical context; and to enable Member countries to improve or establish water management systems. The main objectives of water policy are equitable treatment of users, economic efficiency, development and regional planning, qualitative and quantitative improvement of water resources, cooperation with local administrations, and cooperation with water authorities of other countries. Water management requires substantial scientific, technical and industrial resources. Public participation in policy decisions is needed. Coordination of different types of water management and increasing use of the regional level as the focus for solving water management problems are recommended. Two types of water management instruments are discussed--legal and economic. Legal instruments include controls on the use of water--on abstraction and consumption and on waste water discharged; control by objectives--quality targets, regional planning and development; and technological objectives in water treatment. Economic instruments include fund-raising instruments, use of the 'polluter pays' principle, and financial charges to encourage low water use and good management practices. The effectiveness of the water management instruments is presented. Recommendations include construction of a reference statistical framework; development of standard indicators; development of integrated water management; inclusion of short-term problems in the long-term objectives selected for water policy; and progressive increases in pollution charges. (Cooper-NC)
W79-04856

ULTRASONIC OIL SPILL REMOVAL,
A. Kuris.
U.S. Patent No. 4,126,547, 9 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 3, p 936, November 21, 1978.

Descriptors: *Patents, *Oil spills, *Oil pollution, *Water pollution treatment, Water quality control, Dispersion, Ultrasonics, Homogeneity, Absorption.

Oil slicks on surface waters are dispersed by the exposure of the surface oils to ultrasonic energy to effectuate an homogenization of the oil and water to permit absorption of the oil within the total volume of water. The device for homogenization of the oil into the body of water uses an output radiator or ultrasonic motor for generating longitudinal vibrations of large displacement amplitude adapted to produce periodic perturbations in the oil and reflecting means in a facing relation. The oil to be dispersed is funneled through the gap between the ultrasonic motor and reflecting means for reflecting the vibrations back into the fluid medium consisting of the oil layer and water. The reflecting surface is spaced from the generating means output surface a distance such that the reflected vibrations are substantially in phase with the vibrations radiated into the fluid medium by the output radiator. In this manner, the displacement amplitude of the fluid medium perturbations are increased for the release of oil particles into the fluid primarily by the selective entrainment characteristics of the viscous forces generated by the perturbating medium. The means for removing the dispersed oil particles may include vacuum means for suctioning off the liquid and particles or a fluid sluice means for directing a stream of fluid through a permeable screen. (Sinha-OEIS)
W79-04882

PURIFYING OIL SHALE RETORT WATER,
University of Southern California, Los Angeles (Assignee).
For primary bibliographic entry see Field 5D.
W79-04883

FLOTATION MEANS FOR BARRIER FOR WATER CARRIED POLLUTANTS AND METHOD OF MAKING SAME,
P. Preus.
U.S. Patent No. 4,124,981, 7 p, 6 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 2, p 406, November 14, 1978.

Descriptors: *Patents, *Water pollution control, *Water quality control, Oil pollution, Barriers, Floating, *Oil booms, Containment, Closed-cell foam.

Floating barriers, known generally as oil booms, have great utility in containing and controlling oil slicks and other water carried pollutants on and in bodies of water. This invention is composed of a series of boom sections which are connectable in end to end relationship with each of the boom sections containing a flotation material. The flotable material comprises closed-cell foam, hollow, cylindrical blocks and end closure members for each end of each block. The method of making closed-cell foam, cylindrical block is by rolling and edge sealing a sheet of closed-cell foam material and then sealing end members to each end of eacy cylinder. (Sinha-OEIS)
W79-04891

FLASH REACTOR,
For primary bibliographic entry see Field 5D.
W79-04896

OIL SPILLS: THE STRATEGY OF RECOVERY,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5C.
W79-04904

APPLICATION OF LAND TREATMENT FOR WATER QUALITY IMPROVEMENT,
Purdue Univ., Lafeyette, IN. Dept. Agricultural Engineering.
R. Z. Wheaton.
Paper No. 78-2533, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 3 p. ASAE, St. Joseph, Michigan.

Descriptors: Water quality control, *Land management, Control structures, Cultural control, Soil conservation, Agricultural watersheds, Small watersheds, *Non-point pollution.

Application of land treatment measures is considered to be a means of controlling agricultural non-point pollution. Experiences gained during a demonstration project of these principles is reviewed. The problems of absolute water quality standards and monitoring for compliance of non-point pollution are discussed and alternatives suggested. (Skogerboe-Colorado State)
W79-04905

SUBSURFACE DRAINAGE SYSTEMS INSTALLATIONS IN ARID LANDS--THE STATE OF THE ART,
Advanced Drainage Systems, Inc., Fresno, CA. Dept. of Agricultural Engineering.
G. True.
Paper No. 78-2528, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 2 p. ASAE, St. Joseph, Michigan.

Descriptors: *Subsurface drainage, *Arid lands, Equipment, Materials, Trenches, Irrigated land.

Agricultural drainage contractors are quickly adapting to new techniques and equipment that result in better and more efficient drainage systems. These relatively inexpensive drainage systems are maintaining the long-term viability of irrigated agriculture and increasing crop yields far above the value of energy and capital invested in drainage. (Skogerboe-Colorado State)
W79-04907

DRAINAGE REQUIREMENTS FOR LOW-LAND RICE,
Utah State Univ., Logan. Dept. of Agriculture and Irrigation Engineering.
R. C. Undan, A. L. Phillips, and R. W. Hill.
Paper No. 78-2041, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 21 p. 10 fig, 5 tab, 2 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Drainage, *Rice, Drainage effects, Submerged plants, Submergence, Rainfall, Simulation analysis, Computer models.

Field experiments were conducted in the Philippines with the IR-30 variety to determine the effects of depth and duration of submergence on rice yields, and the data used with rainfall and other physical information as bases for developing guidelines for drainage system capacity selection. (Skogerboe-Colorado State)
W79-04908

AGRICULTURAL DRAINAGE PROBLEMS IN KERN COUNTY, CALIFORNIA,
Kern County Water Agency, Bakersfield, CA.
M. R. Rector, and W. W. Donnan.
Paper No. 78-2532, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 15 p. 3 fig. ASAE, St. Joseph, Michigan.

Descriptors: *Drainage, Drainage area, *Tile drainage, Crop production, Perched water, Salinity, Drilling, Water table, California.

This paper describes procedures followed in the diagnosis, monitoring and evaluation of the drainage problem areas within Kern County, California as a case history for use by others who are facing these same problems. (Skogerboe-Colorado State)
W79-04909

DRAINAGE INSTALLATION EQUIPMENTS 'ECONOMICS OF THE ART',
Speicher Corp., Celina, OH.
C. W. Marsee.
Paper No. 78-2527, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 9 p. ASAE, St. Joseph, Michigan.

Descriptors: Drainage, *Subsurface drains, Equipment, Trenches, Costs.

This paper has two objectives. First, to make the drainage contractor more aware of his cost of operation and his return on investment. Second, to illustrate the cost of operation and return on investment between the wheel and chain trenching machines. (Skogerboe-Colorado State)
W79-04910

FINANCING REGIONAL DRAINAGE FACILITIES UNDER 1978 ECONOMIC CONDITIONS,
Westlands Water District, Fresno, CA.
W. R. Johnston, and L. A. Beck.
Paper No. 78-2535, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Palmer House Hotel, Chicago, Illinois, 12 p. 3 fig, 3 tab. ASAE, St. Joseph, Michigan.

Descriptors: Drainage programs, *Drainage, Financing, Salinity, California, *Cost-benefit analysis, Crop production, Surface drainage, Subsurface drainage.

The benefits, costs, and a recommended financial program to solve saline drainage problems on over 400,000 hectares (1,000,000 acres) of irrigated land in the San Joaquin Valley of California, USA, are discussed. The need to provide long-term financing for major drainage facilities is demonstrated. (Skogerboe-Colorado State)
W79-04911

TRENCHLESS DRAINAGE,
Advanced Drainage Systems, Inc., Columbus, OH.
For primary bibliographic entry see Field 8A.
W79-04912

INTERCEPTOR DRAINS ON SLOPING LAND,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4A.
W79-04916

DESIGN AND OPERATION OF GRADIENT TERRACE SYSTEMS,
Soil Conservation Service, Des Moines, IA.
For primary bibliographic entry see Field 2J.
W79-04918

AN ANALYSIS OF THE FUNCTIONAL CAPABILITIES AND PERFORMANCE OF SILT CURTAINS.
JBF Scientific Corp. Wilmington, MA.
For primary bibliographic entry see Field 5E.
W79-04924

GROUNDWATER AND SALINITY IN THE GRAND VALLEY OF COLORADO,
Science and Education Administration, Fort Collins, CO.
E. G. Kruse.
Paper No. 78-2530, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 21 p, 5 fig, 3 tab, 14 ref. ASAE, St. Joseph, Michigan.

Descriptors: Salinity, *Saline water, Saline soils, Salts, *Groundwater, Colorado, Colorado River.

This paper describes causes and magnitudes of groundwater flows and salt loading in the Grand Valley in western Colorado. Structural measures and management practices most likely to reduce salt loading are described. (Skogerboe-Colorado State)
W79-04985

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

METHODOLOGY FOR DESIGNING COST-EFFECTIVE MONITORING AND COMPLIANCE STRATEGIES FOR PESTICIDE USE,
CONSAD Research Corp., Pittsburgh, PA.
A. D. Bernstein, and R. A. Lowrey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 114, Price codes: A10 in paper copy, A01 in microfiche. EPA-600/5-78-020, September 1978. 195 p, 42 tab, 4 append. 68-03-2448.

Descriptors: *Pesticides, *Methodology, *Monitoring, *Enforcement, *Regulation, *Problem identification and ranking, Local governments, Poisons, Pollutants, Environmental effects, Administration, Federal insecticide, Fungicide, and Rodenticide Act, Federal Environmental Pesticide Control Act, Cost-effectiveness, Public health, Legal aspects, Legislation, Model studies.

To assist in implementing provisions of the 1972 Federal Environmental Pesticide Control Act (FEPCA) which amended the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947, this project assesses the need for and feasibility of developing a methodology for designing cost-effective monitoring and compliance programs, and develops such a methodology. It is noted that the study was not undertaken to actually design specif-

ic monitoring and compliance strategies, but only to ascertain need and feasibility of a design methodology, and to develop a prototype. A method, described in detail, includes: (1) conceptualizing and analyzing the local-level scope and effects of misuse; (2) ranking misuse according to potential damages at the local level; (3) local, state, and regional monitoring of misuse and damages; (4) analyzing and modelling user procedures and behavior; and (5) designing and evaluating compliance strategies. (Lynch-Wisconsin)
W79-04524

IMPROVEMENT OF THE STEADY FLOATING RANDOM WALK MONTE CARLO METHOD NEAR STRAIGHT LINE AND CIRCULAR BOUNDARIES WITH APPLICATION TO GROUNDWATER FLOW,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 2F.
W79-04557

A SIMPLIFIED MODEL OF CORN GROWTH UNDER MOISTURE STRESS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2D.
W79-04607

ON THE CHOICE OF THE 'APPROPRIATE MODEL' FOR WATER RESOURCES PLANNING AND MANAGEMENT,
Harvard Univ., Cambridge, MA. Dept. of City and Regional Planning.
P. Rogers.
Water Resources Research, Vol. 14, No. 6, p 1003-1010, December 1978. 4 fig, 6 tab, 14 ref. OWRT C-7095(6208)(1), 14-34-0001-6208.

Descriptors: *Planning, *Management, *Model studies, Irrigation, Optimization, Project planning, Evaluation, Linear programming, Stochastic programming, Systems analysis, Nonlinear programming, Quadratic programming.

The use of symbolic models has become widespread in water resources planning and management. The operations research literature, however, gives little guidance as to the choice of the most appropriate model for any situation. Outlined herein is a method for comparing models of differing complexity applied to a given situation. The hypothesis that simpler models are more appropriate than more representative but more complex models is tested on two simple irrigation examples. In the first example, the problem is to maximize the net revenue; considered are both a linear and a nonlinear programming model for analyzing this particular problem. The second example considers the choice of appropriate stochastic programming model. The process of cropping choice is modeled using four types of model: (1) linear programming to maximize expected return; (2) factile programming to maximize some fractile of the cumulative distribution; (3) a Markowitz progrm for minimizing variance; and (4) a utility. It is concluded that there is no strong evidence that the less complex models are a more appropriate choice than the more complex ones. However, the possiblility is raised that the errors associated with the choice of the simpler models do lie well within the range of errors that one might expect due to the estimation of parameters in the more complex models. (Bell-Graf-Cornell)
W79-04612

RESERVOIR SYSTEM OPERATING POLICY--CASE STUDY,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
G. H. Toebes, and C. Rukvichai.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. WR1, p 175-191, November 1978. 7 fig, 7 tab, 2 equ, 12 ref. OWRT C-4213(No.9083)(3) 14-31-0001-9083.

Descriptors: *Reservoirs, *Performance, Regulation, Algorithms, Systems analysis, Operating policy, Optimization, Recreation, Simulation analysis, Methodology.

A systematic study was made of the daily or 'short-run' operating practices for an existing reservoir system, consisting of four flood control reservoirs in the Green River basin, Kentucky, having recreation as a secondary objective. Optimization and simulation were combined, with the former serving as a screening tool. Official 'long-run' operating rules were cast into algorithmic form using two system state vectors. Iterative adjustments were then made until the algorithm, called POLICY, yielded a reasonable simulation of a series of around 3,000 historic daily reservoir release decision sets. An algorithm like POLICY permits generating relevant statistical aggregations of short-run and long-run operating practices. This type of condensation of practical operating experience is seen as : (1) a missing link in the search for unifying views of reservoir systems analysis; (2) an essential building block in the construction of practical 'on-line operation' models as well as of 'design analysis' models for use by reservoir regulation staffs of water agencies; and (3) an aid to researchers concerned with technology transfer, i.e., those who seek to judge or increase the applicability of reservoir systems analysis work. (Bell-Cornell)
W79-04616

PLANNING STORM-DRAINAGE SYSTEMS FOR URBAN GROWTH,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 6F.
W79-04618

MATHEMATICAL MODELING OF PESTICIDES IN THE ENVIRONMENT,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5B.
W79-04648

WATER IN LAND USE PLANNING.
New Mexico Wate Resources Research Inst., Las Cruces.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 670, Price codes: A07 in paper copy, A01 in microfiche. WRRI 007, August 1972. Proceedings of the Seventh Annual New Mexico Water Conference, Las Cruces, April 6-7, 1972. 146 p, 45 fig, 14 tab, 19 ref. OWRT A-999-NMEX1(9).

Descriptors: *Land use, *Planning, *Water reso

A compilation of the 17 papers presented at a conference sponsored by the New Mexico Water Resources Research Institute is given. The areas covered include: a progress report on the Bureau of Reclamation's Project Skywater; desalintion; the citizen's role in water and land use planning; groundwater planning for the Mesilla Valley; water use data interpretation for the Rio Grande in New Mexico; hydrologic applications of tritium data; resource management; and potential applications of aerospace earth observations technology to problems of the Rio Grande. The papers of the two panel discussions on water in land development and citizens water conferences are included. (Davison-IPA)
W79-04681

IIASA CONFERENCE' 76.
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
Proceedings of the IIASA Conference '76, Volume 2. International Institute for Applied Systems Analysis, Laxenburg, Austria, 1976. 251 p, 85 fig, 10 tab, 125 ref, 2 append.

Descriptors: *Systems analysis, *Resources, *Environment, *Management, *Technology, *Water resources, *Human settlements, *Human services, Decision making, Regional analysis, River basins, Planning, Computers, Networks, Urban development, Health care, Mathematical models, Equations, Analytical techniques.

A major forum for review of the creation, development, research, and future role of IIASA, this Conference provides a comprehensive report on the first three years of the Institute. This Volume 2 of the proceedings contains presentations, comments, and discussions in the following research areas: Resources and environment, including studies of the Tisza and Vistula River basins, the application of multiattribute utility theory to development planning, and the use of on-line prediction techniques to forecasting short-term agricultural water demand; human settlements and services, including modeling of health care systems, the development of regional land-use models, and inter-regional variations in public goods and services; management and technology, including models and decision-making in integrated regional development; and system and decision sciences, covering a PILOT linear programming model for assessing physical impact on the economy of a changing energy picture, computer networking, and resilience and related mathematical concepts. The table of contents of Volume 1 is appended. (See also W79-04687 thru W79-04689) (Bell-Graf--Cornell)
W79-04686

TISZA AND VISTULA RIVER BASINS: CASE STUDIES,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
Z. Kaczmarek.
In: IIASA Conference '76, Volume 2. The International Institute for Applied Systems Analysis, Laxenburg, Austria, p. 3-7, 1976. 2 fig.

Descriptors: *Water resources, *Planning, *Water management(Applied), *Systems analysis, *River basins, Optimization, Mathematical models, Simulation analysis, Regional analysis, Projects, Programs, Physical processes, Social aspects, Economic aspects.

This brief article considers IIASA case studies in which systems analysis has been applied to derive optimal water resources management in the Tisza and Vistula River basins. Presented is an example of a typical planning scheme wherein the following kinds of models are included: hydrologic, hydrodynamic, transportation, dispersion, water demand, and self-purification of wastes models. Discussed is the question of how to relate the concepts of systems analysis to the problems of regional water resources management. It is concluded that the techniques developed and tested within the framework of the Vistula and Tisza projects have proved to be feasible and technologically workable. The attempt to incorporate in the planning process a specific computational capability to screen, simulate and optimize alternative water resources development programs has demonstrated the merits of the systems approach. (See also W79-04686) (Bell-Graf--Cornell)
W79-04687

APPLYING MULTIATTRIBUTE UTILITY THEORY TO EVALUATION OF TISZA RIVER BASIN DEVELOPMENT PLANS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
E. F. Wood.
In: IIASA Conference '76, Volume 2. The International Institute for Applied Systems Analysis, Laxenburg, Austria, p 9-18, 1976. 2 fig, 3 tab, 9 ref.

Descriptors: *Water resources, *River basin development, *Planning, *Multiattribute utility theory, Evaluation, Assessment, Decision making, Systems analysis, Equations, Tisza River basin(Hungary), Scaling factors, Multiobjective, Qualitative preference.

Water resources development planning is a complicated public investment problem, including: multiple conflicting objectives which involve economic, environmental, social, and technical considerations; difficult-to-quantify consequences that are

crucial in selecting an alternative; and uncertainties concerning the overall impact of a particular alternative. In light of these considerations, the IIASA Water Resources group, in conjunction with the Methodology group, initiated a cooperative study with the Hungarian National Water Authority. This study aimed to: investigate the usefulness of multiattribute utility theory for evaluating alternative water resources development plans; and illustrate the technique for planners and decision makers who influence decisions concerning long-range water resources planning. The Tisza River basin, with five alternative development plans studied earlier, was used for the case-study application. This report highlights the IIASA-Hungarian study; a more detailed report can be found listed in the references. In the study, a utility function over 12 objectives was assessed, and preliminary results indicate that building inter-basin water transfers from the Danube River or from small reservoirs in the northeastern part of the basin is to be preferred to developing three other planning alternatives. (See also W79-04686) (Bell-Graf--Cornell)
W79-04688

COMPARISON OF ALTERNATIVE ENGINEERING DESIGNS,
Waterloo Univ. (Ontario). Dept. of Systems Design.
N. M. Znotinas, and K. W. Hipel.
Water Resources Bulletin, Vol. 15, No. 1, p 44-59, February 1979. 1 fig, 12 tab, 6 ref.

Descriptors: *Projects, *Feasibility, *Water resources, *Evaluation, *Sensitivity, *Comparison techniques, Management, Engineering, Design, Decision making, Political aspects, Economic feasibility, North Dakota, Equations, Systems analysis, Mixed aggregation, Alternatives, Quantitative information, Intangible factors, Fuzzy sets, Net benefit.

Procedures are presented for comparing and evaluating alternative engineering designs for a particular water resources project. By using certain aspects of fuzzy set theory, it is possible to introduce both quantitative and qualitative considerations into the decision-making process. In addition, the viewpoints of the various interest groups involved with the water resources development can be realistically incorporated by the evaluation techniques for the alternative designs. Methods are given for eliminating undesirable alternatives and thereby obtaining a reduced set of possible feasible solutions to the problem. Because of the flexibility of the evaluation methods, the viable alternatives should not only satisfy economical, technical, environmental and other types of constraints, but these possible solutions should be politically feasible as well. A method is formulated for checking the sensitivity of the feasible results with respect to the factors that are considered in the analysis. (Bell-Graf--Cornell)
W79-04690

MODIFIED WATER QUANTITY RECEIVING MODEL FOR FLORIDA CONSERVATION AREAS,
South Florida Water Management District, West Palm Beach, FL.
S. T. Lin, and S. F. Shi.
Water Resources Bulletin, Vol. 15, No. 1, p 155-166, February 1979. 5 fig, 10 ref.

Descriptors: *Florida, *Water supply, *Water quantity, *Receiving water, *Monte Carlo method, *Simulation analysis, *Conservation areas, Water storage, Water demand, Runoff, Rainfall, Inflow, Effects, Computer programs, Equations, Backpumping, Hydraulic radius, Roughness coefficient, Dual elevation, Seepage rate, Hypothetical channel, Energy gradient, Flow velocity, Marsh area, Data requirements, Mathematical models, Systems analysis.

The Conservation Areas in South Florida have been considered as one of the major water storage areas to provide a water supply for the Everglades National Park and Lower East Coast (LEC). Due to the increasing water demands of the area, additional backpumping of the surplus runoff from the LEC area into the Conservation Areas has been considered as one of several alternative plans. The Receiving Water Quantity (EPA, 1971) model has been adapted and modified to be applicable in the Conservation Areas to investigate the possible impact of additional inflow under various backpumping cases. The modification of the model has included Manning's roughness coefficient, depth of flow, width of hypothetical channels through marsh areas, rainfall input, seepage rate, etc. The use of the Monte Carlo technique for area computations was found to be easy and time saving both in area and weighting rainfall input to each node. Comparison of results generated by this modified model with the recorded values in Conservation Areas 1 and 2A indicated that the model not only can be a very good evaluation tool to simulate the hydraulic regime of the Conservation Areas system but also a proper tool for investigating the impact of additional inflow resulting from the back pumping related to the water use planning and management. (Bell-Graf--Cornell)
W79-04691

A VIABLE METHODOLOGY TO IMPLEMENT THE PRINCIPLES AND STANDARDS,
Georgia Univ., Athens. Inst. of Natural Resources.
J. Sellers, and R. M. North.
Water Resources Bulletin, Vol. 15, No. 1, p 167-181, February 1979. 1 fig, 2 tab, 24 ref.

Descriptors: *Water resources, *Planning, *Methodology, *Goal programming, *Principles and Standards, Decision making, Projects, Constraints, Analytical techniques, Equations, Mathematical models, Systems analysis, Optimization, Multiple objective, Cross Florida Barge Canal, Economic values, Environmental values, Integration.

The 'principles and standards for planning water and related land resources' were made effective October 25, 1973. The document was noticeably deficient in suggestions for the necessary implementing procedures to insure its success. Current implementing procedures are based on an incorrect premise of maximizing a single objective subject to nonquantified constraints. A successful implementation of multiple objective planning requires optimizing simultaneously several competitive goals. A system of goal programming has been developed and applied to decision-making situations as a test of its usefulness in planning for multiple objective water resources projects. The result is a project planning process which can be replicated for adjustment in expected resource supplies or demands to provide a tradeoff matrix between economic and environmental objectives as well as traditional functional purposes. This procedure, tested on the Cross Florida Barge Canal, is an integrated analysis of economic and environmental values which may be as effective in implementing multiple objective planning as the 'Green Book' was in developing the now inappropriate benefit-cost analysis.
W79-04692

WATER UTILIZATION AND REALLOCATION IN CHILE: A STUDY OF THE PIRQUE VALLEY,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
L. L. Parks, and D. E. Hansen.
American Journal of Agricultural Economics, Vol. 60, No. 2, p 207-213, May 1978. 1 fig, 2 tab, 8 ref.

Descriptors: *Water utilization, *Water allocation(Policy), *Economic efficiency, *Chile, Farms, Optimization, Linear programming, Methodology, Water supply, Programs, Water law, Mathematical models, Systems analysis, Irrigation distribution, Income distribution.

The 1967 Water Code requires equalization of water rights per hectare in each 'homogeneous farming area.' The analysis of a typical area using linear programming models of representative farms indicates that the equalization of water allocations per unit of land would result in regressive income redistribution, whereas the optimum economic reallocation would result in progressive income redistribution. Aggregate income gains in either case would not exceed 5%. Given the extreme inflexibility of the existing water distribution system, the transaction costs of changing water allocations would probably exceed benefits. (Bell-Graf--Cornell)
W79-04695

ALLOCATION PROCEDURE OF WATER AND LAND RESOURCES IN RELATION TO SOME IRRIGATION QUALITY PARAMETERS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
D. Karmeli.
Water Resources Bulletin, Vol. 14, No. 6, p 1374-1386, December 1978. 1 fig, 3 tab, 5 ref.

Descriptors: *Water resources, *Land resources, *Resource allocation, *Irrigation efficiency, Water costs, Crops, Water supply, Irrigation systems, Equations, Mathematical models, Systems analysis, Estimating, Water-yield functions, Geometric programming, Constraints, Profit maximization.

A procedure is presented for reaching maximal profits from an irrigated farm by optimal allocation of land, water, labor, and capital to the various crops, best irrigation frequency, and level of improvement costs in the irrigation system. The procedure includes the formulation of an objective function based on crop outputs and expenditures. Both outputs and expenditures are adjusted by yield-water-irrigation frequency exponential functions, derived from fits of experimental results. A correction factor for both outputs and expenditures is used to represent levels of irrigation system improvement. The Generalized Geometric Programming method is used to solve the problem of reaching maximal profits from a three-crop farm, subject to constraints. Optimal distribution of land and water, irrigation frequency and optimal level irrigation system improvement are gained for each crop and various sets of market prices. (Bell-Graf--Cornell)
W79-04700

ANALYZING THE IMPACT OF LAND USE ON SEWER SERVICE AREA PLANNING,
Harvard Univ., Cambridge, MA. Dept. of City and Regional Planning.
M. Shapiro, and P. Rogers.
Water Resources Bulletin, Vol. 14, No. 6, p 1340-1356, December 1978. 3 fig, 2 tab, 11 equ, 25 ref.

Descriptors: *Land use, *Effects, *Sewerage, *Planning, *Economics, Optimization, Waste water treatment, Equations, Mathematical models, Systems analysis, Collection systems, Cost functions, Service area analysis, Cost minimization, Sensitivity analysis.

The density and distribution of land uses have important consequences for the planning of sewerage systems and for the costs of these systems. This paper examines these consequences using a simplified service area model which determines the area to be served by a central waste treatment plant, where alternative on-lot disposal systems are also available. The optimization model is applied to various urban area configurations, which are summarized by their total populations and by their population density distributions. Both minimum regional cost and minimum local cost service area configurations are determined. In addition, the sensitivity of the model to the parameters of the cost and population density functions is assessed. It is found that the model is most sensitive to the parameters of the collection cost function. (Bell-Graf--Cornell)
W79-04701

COASTAL ZONE PLAN IMPLEMENTATION,
California Coastal Commission, San Francisco.
E. J. Schoop.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. UP1, p 37-40, May 1978.

Descriptors: *Beaches, *California, *Shore protection, *State laws, *Access routes, *Recreational facilities, Government agencies, Planning, Coastal engineering, Conservation, Urban development.

The California Coastal act of 1976 is designed to enhance public access and recreation, the marine environment, and coastal land resources by requiring development to be compatible with those objectives. A permanent Coastal Commission is established to control development through permits while working with local governments to revise their plans and ordinances in accordance with the Coastal Act. Upon satisfactory completion of local government plans and ordinances by 1981, most of the management of California's coastal zone is expected to be in the hands of local government, but the Coastal Commission will continue in effect to review appeals from improper local government decisions and to review and approve amendments to local plans as may be necessary in the future. (Bell-Graf--Cornell)
W79-04709

REGIONAL WATER SUPPLY PLANNING STUDY FOR NORTHEASTERN ILLINOIS,
Keifer and Associates, Inc., Chicago, IL.
C. J. Keifer, D. E. Westfall, D. A. Fagan, and F. C. Neal.
Water Resources Bulletin, Vol. 15, No. 1, p 17-29, February 1979. 3 fig, 8 ref.

Descriptors: *Water supply, *Long-term planning, *Regional development, *Lake Michigan, *Water allocation(Policy), *Optimum development plans, Computer models, Illinois, Water utilization, Great Lakes, Diversion, Water policy, Water levels, Digital computers, Runoff, Watersheds(Basins), Rivers, Chicago(Ill), Cost-effectiveness, Source analysis, Systems analysis.

The development of a regional water supply system for the six-county area of Northeastern Illinois is presented herein, including: (1) the establishment of regional water supply technical planning policies; (2) the development and utilization of a regional water supply computer model to identify the principal and secondary sources of water supply for each entity in the study area, based on an apparent cost-effective source analysis; and (3) the utilization of the study results to develop for the year 2010 a suggested preliminary regional water supply system. The primary objectives of the computer model are: (1) to identify those sources of public water supply that minimize the total annual costs to construct, operate and finance a regional water supply system in the study area; and (2) to compute the unit cost of water supply for each entity. Using the findings from task 2 above, a proposed plan for overall Lake Michigan water use through 2010 is also developed. The effects of the proposed regional water supply system on future water levels in the deep aquifer are also discussed. (Bell-Graf-Cornell)
W79-04717

CRITICAL REVIEW OF ESTIMATING BENEFITS OF AIR AND WATER POLLUTION CONTROL,
Environment Control, Inc., Rockville, MD.
For primary bibliographic entry see Field 6B.
W79-04762

FLOOD-PLAIN DELINEATION FOR HORSEPEN RUN, SUGARLAND RUN, NICHOLS RUN, AND POND BRANCH BASINS, FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W79-04801

PREDICTIVE ANALYSES OF GROUNDWATER DISCHARGES IN THE WILLOW CREEK WATERSHED, NORTHEAST NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
J. T. Dugan, and E. G. Lappala.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 552, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-67, July 1978. 66 p, 22 fig, 7 tab, 20 ref.

Descriptors: *Surface-groundwater relationships, *Computer models, *Base flow, *Forecasting, *Hydrogeology, Groundwater movement, Groundwater recharge, Hydrologic budget, Irrigation, Climatic data, Nebraska, *Willow Creek watershed.

Ground-water discharge to Willow Creek in northeast Nebraska was predicted with a digital model of the ground-water/surface-water system. Recharge and irrigation requirements were determined with a model of the soil zone. The regional aquifer is Pliocene and Pleistocene sands and gravels. Water in the regional aquifer is unconfined in the western part of the watershed and confined in the eastern part. The confining layer is Pleistocene eolian silts with very fine sand interbeds overlying a basal clay. Where the regional aquifer is unconfined, perennial flow of Willow Creek is sustained by ground-water discharge. Where it is confined, the low hydraulic conductivity of the confining beds isolates the regional aquifer from Willow Creek. Adequate agreement between simulated and observed streamflows and water levels during 1975 and 1976 was obtained by modifying initial estimates of hydraulic conductivity and specific storage. The future perennial flow of Willow Creek was simulated by superimposing six patterns of ground-water withdrawals upon variations in recharge for a monthly climatic sequence identical with the period 1931-34. These analyses showed that the perennial monthly flows would be less than 12 cubic feet per second at least 50 percent of the time. (Woodard-USGS)
W79-04805

ASSESSMENT TECHNIQUES FOR MODELING WATER QUALITY IN A RIVER BASIN AFFECTED BY COAL-RESOURCE DEVELOPMENT,
Geological Survey, Lakewood, CO. Water Resources Div.
T. D. Steele.
Paper presented at: Symposium on Modeling the Water Quality of the Hydrological Cycle, International Association of Hydrological Sciences and International Institute for Applied Systems Analysis, Baden, Austria, September 11-15, 1978. 16 p, 6 fig, 1 tab, 22 ref.

Descriptors: *Coal mine wastes, *Path of pollutants, *Projections, *Model studies, *River basins, Colorado, Wyoming, Surface waters, Groundwater, Regional analysis, Hydrologic data, Simulation analysis, Water quality, Streamflow, Aquifers, Mathematical models, Land use, Water demand, Planning, Evaluation, *Yampa River basin.

A regional water-resources assessment in the Yampa River basin, Colorado and Wyoming, used modeling techniques applied in five component studies to evaluate direct and indirect impacts of coal-resource development. Modeling of the waste-load assimilative capacity of the Yampa River indicated exceedence of a proposed standard for nonionized ammonia concentration using assumptions of anticipated population growth and treatment-plant effluents. Traveltimes for a 50-kilometer reach of the Yampa River ranged from 15.7 hours for seasonal high flow of 28 cubic meters per second to 120 hours for a low flow of 0.8 cubic meter per second; measured reaeration coefficients for selected subreaches ranged from 6.04 to 33.4 per day. Modeling of alternative configurations of proposed reservoirs indicated a reduction of annual time-weighted dissolved-solids concentrations downstream by an estimated 34 percent. By 1990, an increase of between 9 and 27 thousand metric tons of sediment derived from surface-mined areas is estimated to be transported annually in basin streams. Model simulations of a hypothetical 5,000 milligrams per liter conservative contaminant predicted its direction, rate, and dispersion in one of the major coal-bearing aquifers during a 200-year period. The benefits of integrating physically based modeling components for assessing regional water-resources management alternatives are demonstrated. (Woodard-USGS)
W79-04808

COMPUTER MODEL OF TWO-DIMENSIONAL SOLUTE TRANSPORT AND DISPERSION IN GROUND WATER,
Geological Survey, Reston, VA. Water Resources Div.
L. F. Konikov, and J. D. Bredehoeft.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.75. Geological Survey Techniques of Water-Resources Investigations, Book 7, Chapter C2, 1978. 90 p, 19 fig, 5 tab, 15 ref.

Descriptors: *Computer models, *Groundwater, *Subsurface flow, *Path of pollutants, Analytical techniques, Simulation analysis, Equations, Solutes, Dispersion, Groundwater movement, Transmissivity, Groundwater recharge, Water wells, Pumping, Hydrogeology, Solute transport, Particle tracking.

Solute transport in flowing ground water can be simulated with a model that couples the groundwater flow equation with the solute-transport equation. This report documents a digital computer program that uses an alternating-direction implicit procedure to solve a finite-difference approximation to the ground-water flow equation and the method of characteristics to solve the solute-transport equation. The latter uses a particle tracking procedure to represent convective transport and a two-step explicit procedure to solve a finite-difference equation that describes the effects of hydrodynamic dispersion, fluid sources and sinks, and divergence of velocity. The model is both general and flexible in that it can be applied to a wide range of problem types. The program allows the specifications of any number of pumping wells, up to five observation wells, and spatially varying recharge, transmissivity, thickness, boundary conditions, and initial conditions. Mass balance errors will generally be less than 10 percent. (Woodard-USGS)
W79-04813

PREDICTING AND SIMULATING PESTICIDE TRANSPORT FROM AGRICULTURAL LAND: MATHEMATICAL MODEL DEVELOPMENT AND TESTING,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5B.
W79-04920

MATHEMATICAL METHODS FOR ANALYSIS OF FRESH WATER LENSES IN THE COASTAL ZONES OF THE FLORIDAN AQUIFER,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 4B.
W79-04961

A POLICY-ORIENTED SIMULATION MODEL OF DEBRIS PRODUCTION FROM A CHAPARRAL-COVERED WATERSHED,
Wisconsin Univ.-Madison. Dept. of Forestry.
T. M. Bonnicksen.
In: Proceedings of the Symposium on the Environmental Consequences of Fire and Fuel Management in Mediterranean Ecosystems, August, 1977. USDA Forest Service General Technical Report WO-3, p 431-442, 5 fig. (CA. Water Resources Center Project UCAL-WRC-W-499). OWRT-A-058-CAL(3).

Descriptors: *Fire, *Forest management, *Computer models, *Brushlands, *Model studies, Fuels, Burning, Forest fires, Brush control

A policy-oriented computer simulation model was developed for estimating the cumulative volume of debris produced, in cu. yds./sq. mi., from 0.1 square mile watersheds along the southern flank of the Central San Gabriel Mountains. The model

was constructed with a mathematical expectation formula that uses input data computed from equations fitted to nomogram curves from Ferrell's (1959) Report on Debris Reduction Studies for Mountain Watersheds. The computer model was used to evaluate the physical consequences associated with applying different fire management policies to these watersheds, including leaving them unburned, burning them on 15- and 25- year rotations and allowing each watershed to be burned in its entirety once in 50 years, and once every 20 years. The political implications of the simulation results were evaluated with a conceptual model that uses the resources people claim to link interest-groups to particular successional stages in brushland watersheds. (Snyder, Calif.-Davis)
W79-04967

6B. Evaluation Process

OIL SHALE AND THE ENVIRONMENT,
Environmental Protection Agency, Washington, DC.
D. Myers, P. Dorset, and T. Parker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 617, Price codes: A03 in paper copy, A01 in microfiche. EPA-600/9-77-033, October 1977. 29 p, 6 ref.

Descriptors: *Oil shale, *Environmental effects, *Water pollution sources, *Air pollution, *Energy, *Resources development, Colorado, Wyoming, Utah, Green River Formation, Boom-towns, Planning, Research and development, Natural resources, Oil, Oil industry, Federal government, Piceance Basin(CO), Urbanization, Public health, Solid wastes, Fossil fuels.

The oil-shale extraction process, extent of the resource, and environmental dangers are discussed. Research and development are now underway to reduce uncertainties of oil shale production costs, sources of capital, competition from other oil sources and other energy sources, and environmental costs. Most of the oil shale (and the most valuable part) is found largely on federal land in the Green River Formation of Colorado's Piceance Basin (85% of western high grade shale), Utah's Uintah Basin (10%), and in Wyoming (5%). An estimated 80 billion barrels of oil can be recovered using current technology, and 800 billion barrels may ultimately be recovered. The oil is extracted through heating, which breaks the chemical network and cracks the heavy kerogen molecules into smaller molecules. This releases the valuable liquid hydrocarbon mixture, combustible gases, and a coke-like residue. Recovery of one barrel of shale oil uses 2-6 barrels of water, 1-2 tons oil shale, and 100 sq ft of land and produces .33 lb airborne dust, 2.5 lbs polluting gases, 2-5 gal contaminated water, and 1-1.5 tons spent shale. A one-million bbl/day operation, including towns, will occupy about 80,000 acres of land. Direct effects include land and habitat disruption, dust and gas air pollution (currently exceeding federal and state standards), surface and groundwater depletion, increased river salinity, and possible water pollution. (Lynch-Wisconsin)
W79-04522

ECONOMIC AND ENERGY ANALYSES OF REGIONAL WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis. Water Resources Research Inst.
R. J. Heggen, and K. J. Williamson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 098, Price codes: A09 in paper copy, A01 in microfiche. EPA-600/5-78-019, September 1978. 163 p, 24 fig, 17 tab, 93 ref, 10 append. 68-03-2397.

Descriptors: *Water pollution control, *Willamette River Basin(OR), *Energy, *Flow augmentation, *Waste water treatment, *Analytical techniques, *Mathematical models, Regional economics, Regional planning, Planning, Oregon, River basins, Reservoirs, Econometrics, Input-output analysis, Water management(Applied), Model studies, Economics, Dissolved oxygen, Simulation analysis, Industrial wastes, Costs, Alternative planning.

Successful restoration of the Willamette River Basin (Oregon) since the 1950s through wastewater treatment and flow augmentation is used as a case study for retrospective comparison of alternative pollution control methods, focusing on competing demands of the environment, the economy, and energy conservation. Input/output analysis and a dissolved oxygen model shows that: (1) While restoration of dissolved oxygen in the Willamette was in harmony with environmental policies, and resulted in an economic advantage to the basin, summer DO was purchased with fossil fuels needed for long-term economic growth. (2) Savings of $2-4 million annually might have been realized if flow augmentation (which dilutes polluted wastewater) had been increased and treatment decreased. (3) Water quality control cost an estimated $33 million in 1973. (4) In 1973, 510 TJ (terajoule) of direct energy were consumed for pollution control. (5) That year, 1373 primary TJ were required to directly support pollution regulation. (6) Treatment plant construction typically used 0.8 times as many direct joules per dollar as reservoir construction, but 1.4 times as many primary joules. (7) Treatment plant operation, maintenance, and replacement (OMR) used 3.2 times as much direct energy per dollar as did reservoir OMR. Three pollution control methods were simulated: (1) current enforcement and augmentation, (2) less augmentation and increased treatment, and (3) increased augmentation and reduced treatment. (Lynch-Wisconsin)
W79-04523

ASSESSMENT OF BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE FOR SYNTHETIC RUBBER MANUFACTURING WASTEWATER,
Abcor Inc., Wilmington, MA. Walden Div.
M. H. Kleper, A. Z. Gollan, R. L. Goldsmith, and K. J. McNulty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 402, Price codes: A03 in paper copy, A01 in microfiche. EPA-600/2-78-192, August 1978. 181 p, 55 fig, 52 tab, 12 ref, 2 append. 68-03-2341.

Descriptors: *Synthetic rubber, *Industrial water treatment, *Best available technology economically achievable, *Water pollution control, *Water quality standards, Federal Water Pollution Control Act Amendments of 1972, Regulation, Technology, Emulsion crumb rubber, Solution crumb rubber, Latex, Effluents, Effluent limitations, Dual-media depth filtration, Ultrafiltration, Activated carbon adsorption, Reverse osmosis, Ozonation.

Best Available Technology Economically Achievable (BATEA) for wastewater treatment, required by the Federal Water Pollution Control Act Amendments for 1972 for implementation by 1983, is assessed for the synthetic rubber manufacturing industry, categorized by three processes: (1) emulsion crumb rubber, (2) solution crumb rubber, and (3) latex rubber. Technologies recommended also require on-site field tests for a demonstration of their BATEA capabilities. Assessment was based on feasibility tests with actual wastewater samples, both end-of-pipe (untreated) and after primary and secondary treatment. Treatment processes examined included: dual-media depth filtration (DMDF) and ultrafiltration (UF) for suspended solids removal; activated carbon adsorption (ACA), reverse osmosis (RO), and ozonation for removal of dissolved contaminants; and ozonation as a polishing step after RO or ACA for removal for refractory organics. Preferred options are: (1) for emulsion crumb rubber, the proposed BATEA sequence of DMDF and ACA for treatment of effluents from primary/secondary treatment; (2) for solution crumb rubber, the proposed sequence for existing sources with primary/secondary systems currently installed, and for new sources, treatment of end-of-pipe wastewaters by UF and RO with possible water reuse as an alternative to the proposed sequence; and (3) for latex rubber, UF for treatment of tank and tank car washdown streams, with treatment of UF product water and the remaining 10-30% of wastewater flow by biological treatment. (Lynch-Wisconsin)
W79-04525

ENGINEERING AND ECONOMIC ANALYSIS OF WASTE TO ENERGY SYSTEMS,
Parson (Ralph M.) Co., Pasadena, CA.
E. M. Wilson, J. M. Leavens, N. W. Snyder, J. J. Brehany, and R. F. Whitman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 797, Price codes: A20 in paper copy, A01 in microfiche. Report No. EPA-600/7-78-086, May 1978. 264 p, 47 fig, 58 tab, 19 ref, 5 append. EHE 624B, 68-02-2101.

Descriptors: *Engineering, *Economics, *Beneficial use, *Solid wastes, *Energy, *Pyrolysis, *Fuels, *Waste disposal, *Costs, Water pollution sources, Wastes, Waste water disposal, RESGO-Saugus combustion system, Hamilton, Ontario waterwall, Incinerator, Nashville Thermal Transfer Corporation, Chicago-Commonwealth Edison Supplementary Fuel Plant, Georgia Institute of Technology Mobile Agricultural Pyrolysis System, ANDCO-Torrax Air Blown Pyrolysis System, Union Carbide Corporation Oxygen Blown Pyrolysis System, Occidental Research Corporation Flash Pyrolysis System.

Various systems for converting solid wastes (exclusive of mining wastes) to energy are evaluated. Technology is reviewed under four categories: (1) mechanical processing, (2) biological conversion systems, (3) thermal/chemical systems, and (4) combustion. Detailed engineering and economic analysis of seven systems are presented: (1) mass burning combustion systems of RESGO-Saugus and Hamilton, Ontario; (2) Nashville Thermal Transfer Corporation; (3) Chicago-Commonwealth Edison Supplementary Fuel Plant; (4) Georgia Institute of Technology Mobile Pyrolysis System; (5) ANDCO-Torrax Air Blown Pyrolysis System; (6) Union Carbide Purox Pyrolysis System; and (7) Occidental Research Corporation Flash Pyrolysis System. Technology and costs for converting pyrolytic off-gas to methane, methanol, and ammonia is also analyzed. Although some facilities can convert wastes to energy economically there is little information on environmental emissions and effects from the plants, and on physical, chemical, and combustion characteristics of refuse-derived fuels. More research is needed to identify the best equipment for handling and processing solid wastes (most exciting systems were adapted from nonsolid-waste systems), and to develop fundamental information on pyrolysis chemistry. Detailed assessments are given of each of the systems investigated, and environmental pollution data are presented where available. (Lynch-Wisconsin)
W79-04526

ESTIMATING COSTS FOR WATER TREATMENT AS A FUNCTION OF SIZE AND TREATMENT PLANT EFFICIENCY,
Culp, Wesner, Culp, Santa Ana, CA.
R. C. Gumerman, R. L. Culp, and S. P. Hansen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 274, Price codes: A13 in paper copy, A01 in microfiche. EPA-600/2-78-182, August 1978. 282 p, 103 fig, 98 tab, 2 append. CI-76-0288.

Descriptors: *Treatment facilities, *Estimated costs, Size, Efficiencies, *Municipal water, *Water treatment, Costs, Economics, Construction costs, Technology, Operation and maintenance, Potable water, Regulation, National Interim Primary Drinking Water Regulations, Environmental Protection Agency, Water quality standards, Safe Drinking Water Act, Pollutants, Water pollution control, Water purification, Water supply.

Construction, operation and maintenance cost curves are given for 30 municipal water treatment unit processes which individually or in combination are especially applicable for removal of contaminants included in the National Interim Primary Drinking Water Regulations, promulgated by EPA in 1975-76 under the Safe Drinking Water Act of

1974. The final report will include cost curves for over 100 unit processes. For each unit process, conceptual designs were formulated and construction costs developed in tabular format according to eight categories; (1) excavation and sitework, (2) manufactured equipment, (3) concrete, (4) steel, (5) labor, (6) pipe and valves, (7) electrical and instrumentation, and (8) housing. Operation and maintenance requirements were determined individually for energy, maintenance material, and labor. Energy requirements were determined separately for building and process requirements. All costs are as of January 1978. For construction cost updating two methods may be used; (1) use of indices specific to the eight categories, and (2) use of an overall measure such as the ENR Construction Cost Index. Operation and maintenance requirements may be updated readily or adjusted to local conditions, since labor requirements are expressed in hrs/yr and electrical requirements in kilowatt-hrs/yr. A list is given of the most effective treatment methods for 17 contaminants. (Lynch-Wisconsin)
W79-04527

AN ANALYTICAL MODEL FOR ESTABLISHING WATER RESOURCES DEVELOPMENT PRIORITIES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
W. Reid, and W. K. Leung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 562, Price codes: A07 in paper copy, A01 in microfiche. Oklahoma Water Resources Reseach Institute, Oklahoma State University, Stillwater. Technical Completion Report, September, 1978. 125 p, 24 fig, 1 tab, 51 ref, append. OWRT A-072-OKLA(1).

Descriptors: *Priorities, Impoundments, Groundwater, *Delphi method, Political aspects, Project feasibility.

A priority analysis procedure for ranking water resources development project is presented. The procedure is based on a scoring model approach that evaluates water resources development projects in terms of as many as eighteen parameters. It recognizes needs and deficiencies and also incorporates the following features: socio-economic impacts, environmental effects, continuity, and local political reactions. The Delphi technique is used to determine the weights of the individual parameters. For each project, the individual parameters are evaluated and combined through a set of weighting factors into one or two indices that can then be used to rank the projects. The water resources development projects are categorized according to three functional groups, i.e., water treatment facilities, impoundment systems, and groundwater. The projects are ranked within each category.
W79-04586

THE DEVELOPMENT OF A COMBINED WATER QUALITY INDEX,
Arizona Univ., Tucson. School of Renewable Natural Resources.
J. K. Yu, and M. M. Fogel.
Water Resources Bulletin, Vol. 14, No. 5, p 1239-1250, October 1978. 3 fig, 27 ref. OWRT-B-043-ARIZ(29), 14-31-0001-5056.

Descriptors: *Water quality index, *Cost-benefit analysis, *Economic model, Waste water treatment, Pollutants, Methodology, Optimization, Water supply, Irrigation, Recreation, Waste disposal, Decision making, Estimating, Industrial use, Equations, Systems analysis.

Use-oriented benefits and treatment costs analysis has been incorporated into a water quality index to show an economically optimized concentration for the treatment of the pollutants and the resulting water quality. This combined water quality index can be used in decision making at the federal and local government levels. Five major tants, i.e., coliforms, nitrogen, phosphorus, suspended solids, and detergent, have been considered for the municipal waste water. With each higher level of improvement, the treatment costs increase accordingly and the benefits associated with the reuse of this treated waste water will increase also, but not for the nutrient removal in agricultural use. The optimal concentration is determined when the marginal costs equal the margninal benefits. The combined water quality index is the combination of the maximum net benefits and the water quality index of the optimized residual concentrations. This water quality index is zero dollars for the Tucson region in this study. The possible reclaimed use of municipal waste water is for agricultural irrigation and recreational lakes for the Tucson region. (Bell-Cornell)
W79-04610

ECONOMIC VALUATION OF SHORELINE,
G. M. Brown, Jr., and H. O. Pollakowski.
Review of Economics and Statistics, Vol. 59, No. 3, August 1977. p 272-278, 1 fig, 2 tab, 22 ref. OWRT A-072-WASH(2). 14-31-0001-5048.

Descriptors: Economics, *Value, *Shores, Land development, Public policy, Optimization, Land use, Washington, Costs, Prices, Cost-benefit analysis, Property values, Decision making, Social values.

The economic significance of undeveloped shoreline is investigated in the light of three questions: (1) Is the urban land market likely to provide a solution which is Pareto efficient. (2) Are zoning and other building restrictions socially optimal. (3) What contributions can be made by studies of the determinants of property values. The analysis examines: (1) criteria of housing quality attributes taken under consideration by a metropolitan household, such as waterfront open space and proximity to the water; (2) the process and estimation of implicit price formation, employing data on individual dwelling units in a metropolitan area with numerous bodies of water (Seattle, Washington); and (3) inferences from these results about the demand for open space and the welfare gains or losses from changes in the amount of open space. Property values fall with distance from the water, as does marginal cost of property exchanged in a competitive market. Since average cost is greater than marginal cost, an entrepreneur seeking optimal open space cannot cover costs by setting price equal to marginal cost of open space for all beneficiaries. The entrepreneur must either be permitted to deviate from marginal cost pricing or receive a subsidy. The other solution is for the public sector to provide open space through direct action. With falling marginal costs of acquiring open space, it must be calculated whether total benefits of open space are greater than total costs. (Lynch-Wisconsin)
W79-04620

EXPRESSION AND REPRESSION OF SPECIAL INTERESTS IN PLANNING AND MANAGEMENT OF THE MERAMEC PARK RESERVOIR,
Missouri Water Resources Center, Columbia.
J. A. Hartman, and H. F. Lionberger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 679, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, February 1979. 77p, 2 fig, 9 tab, 17 ref, 3 append. OWRT-A-084-MO(1), 14-31-0001-5025.

Descriptors: Planning, Q-Methodology, Reservoirs, *Public participation, Meramec Dam, Social aspects.

A study was made of how people become involved in a controversy, such as the Meramec Dam, and how they structure their opinion positions. The universe of unit ideas which people use to structure their opinions, and the presence of patterns related to sociologically identifiable variables within the social context of the controversy were determined. In the first phase the ideas used in expressing opinions were studied. A second portion included a survey approach in a carefully selected sample of persons -- Q-Methodology. The results show in depth the background thinking, and reasons for participation of both the Pro-Dam and the Anti-Development respondents. (Smith-Missouri)
W79-04647

OPTIMAL IRRIGATION MANAGEMENT STRATEGY UNDER HYDROLOGIC AND IRRIGATION EFFICIENCY UNCERTAINTY REGIMES,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 3F.
W79-04685

MULTISOURCE/MULTIQUALITY AGRICULTURAL WATER USE DECISIONMAKING,
Office of Surface Mining Reclamation and Enforcement (DI), Washington, DC. Branch of Environmental Analysis.
For primary bibliographic entry see Field 3C.
W79-04693

BENEFITS AND COSTS OF WATER QUALITY IMPROVEMENTS,
Environmental Protection Agency, Dallas, TX. Region VI.
E. A. Jeffrey, and J. E. Singley.
Journal of the American Water Works Association, Vol. 70, No. 12, December 1978. 9 ref.

Descriptors: *Cost-benefit ratio, *Water quality control, *Improvement programs, Mathematical models, Estimating, Systems analysis, Decision making, Contaminants, Waterborne diseases, Health benefits, Uncertainties.

A modeling approach is described for estimating benefit-cost ratios for water quality improvement programs. A model is developed for three waterborne diseases to illustrate the feasibility of the approach, which can be used for contaminants other than biological factors. Although both benefits and costs are necessarily estimates, the model lends perspective to and indicates trends for estimating the cost of a water quality improvement as opposed to its health benefits. (Bell-Graf--Cornell)
W79-04699

A PROPOSED METHOD OF EVALUATING FLOOD DAMAGES TO HISTORIC HOMES--AN EXTERNALITY APPROACH,
Army Engineer District, St. Louis, MO.
R. Rodakowski.
Water Resources Bulletin, Vol. 14, No. 6, p 1295-1303, December 1978. 4 fig, 1 tab, 11 ref.

Descriptors: *Flood damage, *Evaluation, *Methodology, *Historic homes, *Depth-damage curves, *Replication, Externality, Demand, Supply, Costs, Probability, Systems analysis.

Traditional procedures for evaluating flood damages to residential dwellings do not reflect intrinsic values when applied to historic homes. Such structures are worth more than that determined by using depth-damage curves provided by insurance companies who assess damage values based upon current labor and material costs. The evaluation of the worth of an historic home and subsequent damages due to inundation can be regarded as a problem of externalities. An assessment technique reflecting historic amenities or what has been termed replication cost is proposed herein. Replication costs would have widespread use not only in solving flood damage problems, but also in any study where historic entities are subject to damages from catastrophies such as hurricanes, soil and beach erosion, and increasing urbanization. If adopted as a technique, it would enhance and preserve the ever-decreasing enclaves of historic homes and neighborhoods. (Bell-Cornell)
W79-04702

ECONOMIC PERFORMANCE OF RESERVOIRS A SENSITIVITY ANALYSIS.
New South Wales Univ., Kensington (Australia)
B. A. Cornish.
Report No. 152, Water Research Laboratory, The

University of New South Wales, Manly Vale, N.S.W., Australia, April 1978. 148 p, 39 fig, 19 tab, 19 ref.

Descriptors: *Water resources, *Reservoirs, *Performance, *Cost-benefit analysis, *Simulation analysis, *Stochastic processes, *Reliability, Estimating, Optimization, Mathematical models, Equations, Systems analysis, Reservoir storage, Flow, Statistical methods, Behavior, Benefit maximization, Sensitivity analysis.

Investigated is the precision with which it is necessary to estimate various parameters of a single reservoir water resource system to achieve any specified accuracy in estimating the returns, and the possible variability of economic returns, which could result from the operation of a single reservoir system; considered as well are developing procedures for determining the optimum development level for the use of water supplied by the system to maximize the mean of the present worth of the return. This study has been carried out using computer simulation of the behavior of a single reservoir on a river in which flow is stochastic. The reservoir is assumed to supply water for a use giving a mometary return. Instead of concentrating on the asymptotic or long-run behavior of reservoirs, the study expresses its results in terms of transient behavior. It is shown that, for each system, there is an optimum demand which maximizes the mean of the present worth of the return from the system, and which is not greatly affected by the life of the system, by the discount rate or by the capacity of the reservoir, but is mainly affected by the mean, the standard deviation and the coefficient of skewness of the inflow into the system. (Bell-Graf--Cornell)
W79-04711

QUALITY CONSIDERATIONS FOR WATER SUPPLY EVALUATIONS,
Engineering-Science, Inc., Arcadia, CA.
D. V. MacDonald, K. P. Barney, Jr., and R. A. Smith.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE2, p 245-258, April 1978. 6 fig, 7 ref.

Descriptors: *Water supply, *Water quality, *Costs, *Crop production, *Consumer acceptance, Dissolved solids, Leaching, Salt tolerance, Crop yield, Benefits, Mineral content, Ventura County(CA.), Regional analysis, Southwest U.S., Evaluation, Agriculture, Methodology.

In regions where the water quality of the sources can vary, the beneficial effects of the higher quality water should be considered. This is particularly true in the Southwestern United States where the mineral content of the water can vary among the various sources such as local ground water, local surface water, and imported water. This paper describes a procedure that was used in a water supply study in Ventura County, California. The study involved the evaluation of several sources of water having varying mineral contents. The procedure used considers the additional consumer costs for high mineral content water for both the domestic and industrial user. The procedure also develops the agricultural benefit costs for the lower water requirements and the higher crop yields associated with lower mineral content water. The total project costs of an alternative should be adjusted by the proper benefit cost accrued through the use of a high quality water. (Bell-Cornell)
W79-04714

ECONOMIC ISSUES RELATED TO LARGE-SCALE WATER TRANSFERS IN THE USA,
Colorado Univ., Boulder. Dept. of Economics.
For primary bibliographic entry see Field 6D.
W79-04759

SOCIAL AND ECONOMIC ASPECTS OF WATER EXPLOITATION,
C. Widstrand.
Water Supply and Management, Vol. 2, No. 4, p 279-282, 1978.

Descriptors: *Social aspects, *Irrigation, *Potable water, *Water supply, *India, *Africa, Economics, Public benefits, Public health, Human diseases, Administration, Water allocation(Policy), Water management(Applied), Social participation, Political constraints, Governments, Planning, Water supply development.

Economic and social aspects of Indian subcontinent irrigation programs and East African rural drinking water projects are discussed. Expected social benefits from clean drinking water supplies in the latter area over the last decade have not been realized, and a century of large-scale irrigation works on the Indian subcontinent have created numerous problems. None of these projects have met expectations and most facilities are used to only 50% of capacity. Health improvements from the drinking water schemes have been limited by: (1) fecal or other contamination of the new water supplies, (2) failure to use the new sources during the wet season when closer water sources may be available, (3) bias in favor of pumps or lack of water pressure. Provision of water supplies has been the domain of engineers, with little input from economists and none from social scientists, and questions of operation and maintenance were neglected. Planning was accomplished without local participation or consideration of the needs of the people affected. Two notable problems accompany irrigation projects: (1) outbreak of such diseases as malaria and schistosomiasis, and (2) the conflict between water availability and allocation according to real needs. Failure to resolve the allocation problem will make water an important factor in the distribution of economic and political power. (Lynch-Wisconsin)
W79-04760

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER CONVEYANCE SYSTEMS: 1973-1977.
Dames and Moore, Denver, CO.
U.S. Environmental Protection Agency, Technical Report No EPA 430/9-77-014, MCD-38, May 1978. 180 p, 3 fig, 23 tab, 4 append.

Descriptors: *Construction costs, *Sewerage, *Conveyance structures, *Waste water(Pollution), *Pipes, *Construction grants program, *Public participation, Environmental Protection Agency, Grants, Financing, Municipal wastes, Estimated costs, Estimating, Costs, Economics, Sewers, Domestic wastes, Waste water conveyance, Manholes, Social participation, Federal Water Pollution Control Act Amendments of 1972, Citizen participation.

Construction bid data for municipal wastewater conveyance systems from all 10 U.S. Environmental Protection Agency regional offices provide a nationwide reference for estimating future facilities costs. A method is also described which enables citizens to estimate the cost and tax burden of a proposed sewer system. All 455 facilities were municipally owned systems funded under the Federal Water Pollution Control Act Amendments of 1972. Costs for collector and interceptor projects and for associated pump stations and force mains were included, but costs for cast-in-place sanitary sewer pipes were not available. In addition, costs for grant allotment Step I (facility planning, cost-effectiveness analysis, and preliminary sewer design), Step II (detailed plans and specifications), and the nonconstruction portion of Step III (construction phase) were collected and analyzed, but costs of treatment facilities were not included. Costs cover labor and materials per foot of sewer in place, in 1977-78 values. Costs for manholes, pipe casing, and special bedding are given both in totals and itemized. The EPA intends to update cost data on a regular basis. The EPA and U.S. Army Corps of Engineers are refining the CAPDET model for the design and evaluation of wastewater treatment systems to allow estimation of conveyance costs. (Lynch-Wisconsin)
W79-04761

CRITICAL REVIEW OF ESTIMATING BENEFITS OF AIR AND WATER POLLUTION CONTROL,
Environment Control, Inc., Rockville, MD.
A. Hershaft, A. M. Freeman, III, T. D. Crocker, and J. B. Stevens.
Report No EPA-600/5-78-014, June 1978. 1HA094. 68-01-2821.

Descriptors: *Air pollution, *Water pollution control, *Benefits, *Economics, *Welfare(Economics), *Cost-benefits analysis, *Pollution abatement, *Methodology, Alternative planning, Planning, Policy, Water pollution effects, Air pollution effects, Model studies, Mathematical models, Recreation demand, Willingness to pay, Social values, Research priorities, Public benefits, Environmental Protection Agency, Estimating, Monitoring, Public health, Property values, Damage functions, Social aspects, Evaluation, Analytical techniques.

Individually authored critiques of methodologies for estimating benefits cover pollution control in general, air pollution control, and water pollution control. Though the conceptual basis provided by economic theory for benefit estimation is adequate in most respects, empirical data are insufficient. Several studies fail to explicitly list critical assumptions or to adequately express certainty in results, and some have used inappropriate conceptual models. Damage functions underlying benefit estimates frequently are based on insufficient data or poor characterization of exposure and effects, and many national benefits estimates are derived from regional studies not intended for such extrapolation. Recommendations: (1) funding for benefits estimation research should be increased; (2) a comprehensive national plan for coordinated regional benefit studies should be developed; and (3) benefits of past and current pollution control programs should be evaluated. The primary problem in assessing water pollution control benefits is a lack of generalizable behavioral relationships between water quality and consumer behavior, and thus willingness to pay for improvements. This report was partly based on a two-day conference on benefits estimation. (Lynch-Wisconsin)
W79-04762

WATER-ORIENTED OUTDOOR RECREATION IN THE ILLINOIS RIVER BASIN (APPENDIX VD--ILLINOIS-INDIANA-WISCONSIN.
Bureau of Outdoor Recreation, Philadelphia, PA. Northeast Regional Office.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 296, Price codes: A08 in paper copy, A01 in microfiche. Sponsored by U. S. Dept. of Health, Education, and Welfare, Public Health Service, Region V, June 1964, 158 p, 2 tab, 1 appendix, 1 map.

Descriptors: *Water quality, *Water resources development, *Recreation, *Recreation demand, *Illinois River Basin, *Illinois, Public health, Water utilization, Regional planning, Water pollution, Water transportation, Data collection, Land use, Outdoor recreation, Water quality standards, Indiana, Wisconsin.

The demands for water-based recreation activities are expected to increase in the next few decades. However, as the demand for water recreation opportunities grows, the number of suitable water areas declines and competition for available areas increases. The water recreation situation in the Illinois River Basin is worsening because demand is increasing faster than supply. The purposes of this report are: (1) to evaluate existing water recreation opportunities in the Illinois River Basin and its zone of influence; (2) to determine furture needs for recreation areas and facilities; (3) to identify potential recreation areas; and (4) to recommend actions or programs to improve the Basin's water recreation opportunities, both new and in the future. The Illinois River Basin comprises more than 44,000 square miles, 85% of which is located in Illinois, and whose population is 85% urban. The major problem in meeting demand for water-based recreation is water pollution. The report lists all present and potential water-based recreation

sites, their acreage, location, water quality, and types of activities possible at the sites. An extensive list of suggested actions to meet this future demand and government programs relating to water-based recreation development is present. (Coan-NC)
W79-04853

WATER MANAGEMENT POLICIES AND INSTRUMENT.
Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 5G.
W79-04856

REPORT OF THE DENVER WORKSHOP ON STATE-LOCAL-FEDERAL RELATIONSHIPS IN SOCIOECONOMIC IMPACT ASSESSMENT,
Denver Research Inst., CO. Industrial Economics Div.
R. Schneider, and J. S. Gilmore.
Sponsored by the Resource and Land Investigations Program, U.S. Geological Survey, Denver, Colorado. December 15-16, 1976. 44 p, 1 fig, 7 appendices.

Descriptors: *Assessments, *Planning, *Impacts, *Energy impacts, *Impact studies, *Socioeconomic impacts, Evaluation, Energy, Resources development, Legislation, Colorado, Montana, New Mexico, Wyoming, North Dakota, Utah, Navajo Nation, Energy development.

This is a summary of discussion among Federal, state, academic, and local participants in a two day workshop of the socioeconomic impacts caused by energy resource development in the Rocky Mountain and Northern Plains states. Three general criteria were proposed by the Energy Research and Development Administration (ERDA): the initiative and responsibility of the states for problem-solving must be preserved, enhanced and facilitated; Federal impact assistance should be broadly legislated and not be tied to specific and potentially obsolete energy technologies; and that states should enter the decision-making process concerning impacts from a regional perspective, actively soliciting regional and local input. Examined are the impact decision approaches of Colorado, Montana, New Mexico, Wyoming, the Navajo Nation, North Dakota and Utah. Both Montana and Wyoming have comprehensive environmental energy legislation providing for local and citizen input into decisions arising from impacts of energy policies and energy facilities siting. An Epilog sets out legislative changes made by the states in their impact assessment activities since in Conference was held. The Resources and Land Investigation (RALI) program is described in Appendix D. (Arnold-NC)
W79-04858

STONY BROOK HARBOR: AN INTERDISCIPLINARY ANALYSIS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
S. K. Robbins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 442, Price codes: A06 in paper copy, A01 in microfiche. June 1977. 115 p, 24 fig, 6 tab, 93 ref, 3 append.

Descriptors: *Coasts, *Water quality, *Harbors, *Land use, *New York, *Stony Brook Harbor(NY), Water pollution control, Water resources development, Shore protection, Jurisdiction, Management, Recreation, Wetlands, Biota, Coastal Zone Management.

The purpose is to organize and evaluate data and knowledge concerning a marine resource so that it is presented in a form useful to managers and planners. The first step in the development of an information base for a resource such as Stony Brook Harbor is the definition of the resource, i.e., the collection and compilation of data and knowledge relevant to both the physical and human environments of the study area. This included obtaining information on geologic structure, wetlands, uplands, biota, water quality, shoreline development and stability, hydrography and sediments. Other steps included delineating the patterns of use (past, present and alternative) and their compatibility; distributing governmental authority; and managing and planning policies. Stony Brook Harbor is located on the North Shore of Long Island on the boundary of Smithtown and Brookhaven Townships, in Western Suffolk County. It is used as a recreational water body for activities such as boating, clamming, swimming, and fishing. There is very little industry in the area and water pollution from this source is negligible. A short history of the harbor area is given describing the settlement patterns in the 18th, 19th, and 20th centuries. Indirect and direct conflicts between users of the harbor are presented showing the major source of direct conflict is over space requirements. The major source of indirect conflict is the alteration of the marine environment by two users, boaters and shoreline residents. This paper can serve as an example of a study that could be done for other Long Island Harbors and bays, as a first step in the development of management plans for their use. (Arnold-NC)
W79-04862

A FEASIBILITY STUDY FOR DEVELOPING A RESERVOIR ON BIG COW CREEK, NEWTON COUNTY, TEXAS.
Sabine River Authority of Texas, Orange; and Henningson, Durham and Richardson, Inc., Henderson, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 703, Price codes: A10 in paper copy, A01 in microfiche. Department of Commerce Economic Development Administration Technical Assistance Project October, 1976. 197 p. 08-6-01623.

Descriptors: *Water quality, *Water supply development, *Water resources development, *Water resources, *Water demand, *Reservoirs, *Environmental effects, *Feasibility studies, *Newton County(TX), *Big Cow Creek(TX), *Multi-purpose projects, Reservoir storage, Water storage, Engineering structures, Economics, Economic feasibility, Natural resources, Flora, Fauna, Wildlife, Hydrology, Biology, Climatic data, Environmental control, Sabine River(TX), Historic resources.

On October 15, 1975 the Sabine River Authority of Texas authorized the preparation of a feasibility study for developing a reservoir on Big Cow Creek in Newton County, TX. The report is divided into 4 sections: study evaluation and summary, engineering and economics, environmental considerations, and evaluation of historic and prehistoric resources. The storage capacity of the reservoir will be 34,200 acre feet (AF) covering about 2,600 acres and costing an estimated $12,026,332. The reservoir would be capable of passing a 100-year flood. The watershed is primarily undeveloped pine and hardwood forest with forest covering over 90% of the area. The project will be multi-purpose providing municipal water supply, increased recreation facilities, flood control, irrigation water, and water for industrial users. Data are presented on water quality in the area, the financial aspects of the project, the engineering requirements of the reservoir, hydrological characteristics of the area, and the geological and biological impacts of the reservoir on the local economy and environment. It is estimated that the reservoir would be adequate to provide water needs to the year 2025, but alternative surface water supplies might be necessary to meet industrial water needs in the next 25-50 years. Short and long-term adverse effects are discussed with alternatives to the proposed action considered. A preliminary evaluation of the recorded historic and prehistoric resources in the area is presented indicating that no federal or state registered historic sites are threatened by the proposed reservoir. (Coan-NC)
W79-04867

A SOCIO-ECONOMIC FEASIBILITY STUDY OF THE PROPOSED ROCHESTER DAM,
W. L. Hoffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 888, Price codes: A05 in paper copy, A01 in microfiche. Department of Commerce, Technical Assistance Project, Economic Development Administration. November, 1977. 78 p, 6 fig, 19 tab, 22 ref.

Descriptors: *Dams, *Cost benefit analysis, *Agriculture, *Reservoirs, *Rochester Dam(KY), *Economic impact, *Social impact, Recreation, Reservoir construction, Construction costs, Economics, Land use, Navigation, Industry, Income, Project benefits.

This study examines the desirability of construction of a multipurpose dam on the green River in Butler, Kentucky. The purpose of the proposed Rochester Dam is to create a wide range of economic and social benefits for the area. The proposed project would flood 52,000 land acres, requiring the purchase of 71,000 acres in all. An estimated 240 families would have to be relocated, with some 50,500 acres of crop and pasture lands being inundated. The proposed maximum pool elevation of 420 feet would have no effect on the subteranean streams in Mammoth Caves, but the author believes further study should be undertaken to insure the integrity and well-being of this natural resource. The area is rural, with low median income, and suffers from out-migration and under-and unemployment, with limited industrial and commercial potential. Costs and benefits of the project are presented. The findings indicate that although agricultural crop losses would occur--estimated at over $300 million over a 50 year period--and a loss of a sense of community by part of the population would result from resettlement, the overall benefits justify construction of the dam. These benefits include revitalization of the area's economy through construction employment; purchases of goods and commodities by the federal government and local construction workers, which would spur employment and purchase of services; recreation benefits, providing both recreation resources and increased employment; increases in land values and the construction of vacation homes; opening of the area to river navigation; providing industrial opportunities and benefits; and hydroelectric energy production. Flood control and water supply are not considered significant. Construction of the Rochester Dam is recommended. (Arnold-NC)
W79-04869

IMPROVEMENTS NEEDED IN THE CORPS OF ENGINEERS' REGULATORY PROGRAM FOR PROTECTING THE NATION'S WATERS.
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 312, Price codes: A02 in paper copy, A01 in microfiche. December 23, 1977. 16 p, 1 tab.

Descriptors: *Water quality, *Wetlands, *Water resources planning, *Impacts, *Water pollution control, *Corps of Engineers, Permits, Federal Water Pollution Control Act, Water management(Applied), Regulatory programs, Impact assessments.

This report assesses the aspects of the need for improvement in the Army Corps of Engineers' implementation of Sections 10 and 404 of the 1972 Federal Water Pollution Control Act Amendments. The GAO, concluded that headquarters and districts will have management and evaluation difficulties until the Corps (1) defines the geographical boundaries of its Section 10/404 regulatory program, (2) provides for more consistency between districts in interpreting and applying regulations and guidelines, (3) defines methods to be used to achieve program results, and (4) provides for periodic review of program results. It was found that Corps failure to specifically identify geographical boundaries within each district led to confusion over which area actually would be covered by Corps permits. The need for the Corps to better coordinate its permits with similar ones required by EPA was identified. Additional guidance to Corps districts needs to be provided to reconcile conflicting interests which may be involved. Peri-

odic evaluation should be made specifically to provide more data on the wetlands regulatory program. (Arnold-NC)
W79-04871

RECREATIONAL BOATING ON THE TIDAL WATERS OF MARYLAND. A MANAGEMENT STUDY.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 068, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Maryland Department of Natural Resources, Energy and Coastal Zone Administration and NOAA, Office of Coastal Zone Management, Washington, DC. 1976. 226 p, 14 fig, 22 tab, 5 appendices.

Descriptors: *Water quality, *Tidal waters, *Water users, *Shore protection, *Environmental effects, *Outdoor recreation, *Recreation demand, *Recreation facilities, *Boating, *Coastal zone management, *Chesapeake Bay, *Navigational safety, Estuaries, Fish management, Ecosystems, Environmental control, Zoning, Management, Maryland, Carrying capacity, Spatial capacity, Licensing, Congestion, Resources management.

The tidal waters of Maryland are priceless recreational resources, unique estuarine ecosystems, essential navigation routes, and valuable assets for waterfront land. The recent increase in recreational boating activity and facility construction prompted an assessment of the problems arising from such activities and the development of a planning framework to identify and rectify these problems. This report studies the environmental effects of boating and develops a planning process and management strategy which will allow administrators, private boaters, and concerned citizens to consider problems and alternative solutions. Congested areas on the tidal waters and existing problems are identified through qualitative surveys of boater perceptions and State Police observations, consultations with officials, and analysis of accident loci. A review of relevant environmental literature was undertaken to determine the degree to which ecological effects and impacts could be attributed to recreational boating activities and facility development. Information relevant to both user-related concerns and environmental sensitivities and geographical management units are delineated and classified. It was found that localized overcrowding is a serious concern; accident occurance rates have not increased in spite of increases in number of boats registered; demand for boating facilities greatly exceeds supply; boating facilities impinge on sensitive shoreline resources; it will be necessary to increase State Dept. of Natural Resources capabilities for dealing with boating activities and facilities development. Management alternatives to ameliorate boater and environmentally related alternatives are presented. (Coan-NC)
W79-04876

COMPUTER PROGRAMMING SOLID SET SYSTEMS,
Toro Co., Riverside, CA.
For primary bibliographic entry see Field 3F.
W79-04913

A METHODOLOGY FOR DETERMINING LAND VALUE AND ASSOCIATED BENEFITS CREATED FROM DREDGED MATERIAL CONTAINMENT,
SCS Engineers, Reston, VA.
For primary bibliographic entry see Field 5E.
W79-04933

PRELIMINARY ASSESSMENT OF POLICY AND MANAGEMENT OPTIONS FOR GROUNDWATER MINING IN THE GREAT PLAINS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 4B.
W79-04957

SUMMARY REPORT OF PHASE II. DEVELOPMENT OF TECHNIQUES FOR ESTIMATING THE POTENTIALS OF WATER RESOURCES DEVELOPMENT IN ACHIEVING NATIONAL AND REGIONAL SOCIAL GOALS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 030, Price codes: A02 in paper copy, A01 in microfiche. Report PRWG-112-1. May 1973 Edited and published at the California University, Riverside, 15 p. OWRT C-3337(No. 3721)(10).

Descriptors: *Planning, *Social values, *Decision making, *Water policy, Evaluation, Social aspects, Model studies, Conservation, Recreation, Aesthetics, Water resources development.

A concept for comprehensive evaluation of effects of water resource use and development was proposed in Phase I. (See W72-00796). Nine general word described goals thought collectively to be comprehensive were articulated into successive hierarchical sets of subgoals seen as eventually linked to social indicators that are perturbed by water actions. By devising connectives among the elements of the goal tree, social indicators and action variables, relative social effects for alternatives can be studied. Phase II developed a number of working papers on various aspects of the methodology in anticipation of a field test. Results of these working papers are summarized. Topics include algorithmic approaches to semi- or non-quantifiable connectives, documentation of specific quantifiable connectives, hydrological interactions with social indicators, recreational quality and supply, ecological resiliency, action variables, alternative action plants, equality, cognitive aspects of social indicators, quantification of aesthetics and results of some preliminary tests based on the Dorfman-Jacoby theoretical Bow River case and Perris Dam in California. (Peterson-Utah)
W79-04965

ECONOMIC ANALYSES OF MULTIPLE PIVOT IRRIGATON ON A DROUGHTY SOIL,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W79-04995

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

A MODEL FOR DETERMINING THE IMPACT OF CONTROL COSTS ON MUNICIPAL FINANCES,
Army Concepts Analysis Agency. Bethesda, MD.
A. C. Rucks.
Journal of the Water Pollution Control Federation, Vol. 51, No. 1, p 43-52, 1979 January. 2 fig, 11 tab, 5 ref.

Descriptors: *Water pollution control, *Costs, *Effects, *Municipal finances, *Micro analysis, Methodology, Waste water(Pollution), Measurement, Mathematical models, Systems analysis, Data analysis.

The objective of the micro analysis model is to measure the impact of alternative water pollution control facility financing methods on the operating position of a municipality's water and sewer fund. The four alternative methods included in the model taxonomy are representative of the local, state, and federal sources of capital that are generally available to municipalities. Model methodology consists of the preparation of pro forma financial statements based on trend analysis of the water and sewer fund financial conditions. These pro forma financial statements present clear pictures of the deficit or surplus conditions that can be expected under each of the facility financing methods. (Bell-Graff--Cornell)
W79-04698

ECONOMICS OF ON-FARM METHODS OF CONTROLLING SEDIMENT LOSS FROM SURFACE-IRRIGATED FIELDS,
For primary bibliographic entry see Field 4D.
W79-04756

'SCOPE FOR VALUATION OF ENVIRONMENTAL GOODS': COMMENT,
University of New England, Armidale (Australia). Dept. of Agricultural Economics.
P. W. O'Hanlon, and J. A. Sinden.
Land Economics, Vol. 54, No. 3, p 381-387, August 1978. 2 tab, 3 ref.

Descriptors: *Value, *Methodology, *Pricing, *Economics, *Parks, *Social values, *Recreation demand, Australia, National Parks, New South Wales(Australia), Marginal utility, Prices, Equilibrium, Surveys, Attitudes, Goods, Services.

Modifications reduce the subjectivity of Pendse and Wyckoff's method (1974) of estimating values for unpriced environmental goods and services and improve its precision through resurveys, a test between sets of prices, and an explicit attempt to bracket the range of each price. The revised method was applied to a proposed National Park at the headwaters of the Macleay River, New South Wales, Australia. The original methodology simulates operation of a competitive market; at equilibrium the marginal utility per unit of expenditure on any one good equals the marginal utility per unit on any other good. This condition is translated into a simple test (implemented through questionnaires) for indicating adjustments to experimental prices in order to move to equilibrium prices. Comparison of random or expected frequencies of choice (E) with observed frequencies (O) shows how well given prices reflect marginal utilities or values. An O/E ratio greater than 1.0 implies that prices underestimate respondents' values since the quantity chosen is too high, and prices must be increased to estimate equilibrium prices; for a ratio less than 1.0 the reverse holds true. It is noted that the method indicates the direction but not the magnitude of the needed adjustment. The proposed resurveys and tests between sets of prices offers a more systematic means of selecting a price matrix. (Lynch-Wisconsin)
W79-04757

DRAINAGE INSTALLATION EQUIPMENTS 'ECONOMICS OF THE ART',
Speicher Corp., Celina, OH.
For primary bibliographic entry see Field 5G.
W79-04910

6D. Water Demand

APPLICATION OF ON-LINE PREDICTION TECHNIQUES TO FORECASTING SHORT TERM AGRICULTURAL WATER DEMAND,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
A. Szollosi-Nagy.
In: IIASA Conference '76, Volume 2. The International Institute for Applied Systems Analysis, Laxenburg, Austria, p. 19-23, 1976. 2 fig, 8 equ, 5 ref.

Descriptors: *Water demand, *Short-term planning, *Forecasting, *Irrigation systems, *Tisza River Basin(Hungary), Probability, Algorithms, Equations, Systems analysis, Dynamic model, Dynamic recursive prediction, Harmonic series model, Computers.

An urgent problem in the Tisza River basin is the short-term control of its irrigation systems which are of great economic significance. Discussed herein is a proposed discrete, dynamic recursive prediction algorithm that is based on the state space description of the processes involved. The algorithm can readily be embedded into an on-line control scheme. Because of the recursiveness, the scheme is easy to implement even for small process computers. It is simply adapted to suit the changing environment, and the algorithms might be embedded without change in the optimal control scheme for the irrigation system. (See also W79-04686) (Bell-Graf--Cornell)
W79-04689

SUPPLY-DEMAND PRICE COORDINATION IN WATER RESOURCES MANAGEMENT,
Milan Univ. (Italy). Ist. di Elettrotechnica ed Elettronica.
G. Guariso, D. Maidment, S. Rinaldi, and R. Soncini-Sessa.
RR-78-11, International Institute for Applied Systems Analysis, Laxenburg, Austria, July 1978. 24 p, 10 fig, 3 tab, 3 equ, 10 ref.

Descriptors: *Water supply, *Water demand, *Coordination, *Prices, *Water management(Applied), *Methodology, Water utilization, Water delivery, Networks, Optimization, Inter-basin transfers, Mexico, Mathematical models, Equations, Systems analysis, Linear programming, Benefit maximization, Interaction graph, Disaggregated approach, Aggregated approach.

Presented is a price coordination scheme for solution of a complex regional water management problem; the problem specifically is to coordinate by prices the water supplies and demands in a region. The objective is to maximize the total regional net benefit from water use, and it is achieved when the marginal benefit at each demand point is equal to the marginal cost of delivering water to that point. The class of problems to which the scheme can be applied is determined from the graph of the network connecting supplies and demands. An example is presented in which the scheme is applied to analyze possible interbasin water transfers in the Northwest Water Plan in Mexico. The method works in the 'marginal domain,' thus making use of demand and supply models describing the economy of the single units of the system. The scheme is essentially a one-dimensional search coordinated by a supervisor. Its advantages with respect to aggregated cost-benefit analysis are the saving of computation time and memory requirements, the fact that the information structure needed is highly decentralized, and the fact that the marginal benefits or costs associated with each unit are explicitly obtained as part of the problem solution. (Bell-Graf--Cornell)
W79-04718

'SCOPE FOR VALUATION OF ENVIRONMENTAL GOODS': COMMENT,
University of New England, Armidale (Australia). Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W79-04757

ECONOMIC ISSUES RELATED TO LARGE-SCALE WATER TRANSFERS IN THE USA,
Colorado Univ., Boulder. Dept. of Economics.
C. W. Howe.
Water Supply and Management, Vol. 2, No. 2, p 127-136, 1978. 2 tab, 3 ref.

Descriptors: *Economics, *Water transfer, *Water shortage, *Regional economics, *Cost-benefit analysis, *Planning, *Demand, Regional planning, Regional development, Economies of scale, Financing, Economic efficiency, Arid lands, Energy, Water management(Applied), Economic feasibility, Benefits, Costs, Water supply, Theoretical analysis, Interbasin transfers.

Benefits, costs, timing, and financing of existing and proposed water transfer systems are assessed. Existing systems include New York City, Los Angeles, and the Colorado-Big Thompson projects, and proposed systems include the Columbia River Basin, Texas-New Mexico high plains, and the lower Mississippi projects. Economic benefit issues: (1) low benefits in agriculture, (2) agricultural displacement effects, (3) efficiency of use of transferred waters, (4) benefits along the transfer route, and (5) secondary benefits. Economic cost issues: (1) energy intensity and energy recovery, and (2) water opportunity costs and other externalities. Project timing is critical; premature construction means unused capacity for long periods, while deferring construction leads to interim use of costly short-term supplies or delayed regional growth. The low unit value of water and economies of scale in all water transfer technology imply that interregional transfers must be large to be economically feasible. Inefficient large-scale water projects are much less likely to be undertaken if public financial policy requires direct and secondary beneficiaries to pay a major portion of construction, operating, and maintenance costs. In early transfer projects financing was done completely by the water utility by means of bonds paid off through volume charges to users, while federal financing has resulted in many inefficient projects. Full cost recovery is recommended. (Lynch-Wisconsin)
W79-04759

HYDROLOGIC APPRAISAL OF THE WATER RESOURCES OF THE HOMER-PREBLE VALLEY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
W. Buller.
Geological Survey Water-Resources Investigations 78-94 (open-file report), 1978. 31 p, 8 fig, 7 tab, 15 ref.

Descriptors: *Water suply, *Surface waters, *Groundwater, *Available water, *Water quality, Hydrologic data, Hydrogeology, Water analysis, Potable water, Planning, Construction, New York, *Homer-Preble Valley.

Water resources of Homer-Preble Valley, 1 to 2 miles wide and 9 miles long, in central New York, were appraised because the area is expected to undergo considerable residential development in the near future. The main source of water supply to the residents of the area is the glacial-outwash aquifer. Data indicate that additional pumpage of 5 million to 10 million gallons per day from the aquifer would not seriously reduce the quantity and quality of the water supply. Water-quality analyses indicate that ground water and surface water in the valley are suitable for most uses and generally meet State standards for source waters for drinking. (Woodard-USGS)
W79-04796

WATER POLICY AND DECISION-MAKING IN THE COLORADO RIVER BASIN,
California Univ., Santa Barbara. Dept. of Political Science.
For primary bibliographic entry see Field 6E.
W79-04868

PLANNING STATUS REPORT: WATER RESOURCE APPRAISALS FOR HYDROELECTRIC LICENSING--LOWER WHITE RIVER BASIN, MISSOURI-ARKANSAS.
Federal Energy Regulatory Commission, Washington, DC. Bureau of Power.
For primary bibliographic entry see Field 4A.
W79-04872

PLANNING STATUS REPORT: WATER RESOURCE APPRAISALS FOR HYDROELECTRIC LICENSING--UPPER WHITE RIVER BASIN, MISSOURI AND ARKANSAS.
For primary bibliographic entry see Field 4A.
W79-04873

WATER BANKING: HOW TO STOP WASTING AGRICULTURAL WATER,
California Univ., Berkeley. Graduate School of Public Policy.
For primary bibliographic entry see Field 3F.
W79-04875

6E. Water Law and Institutions

INSTITUTIONAL ARRANGEMENTS FOR EFFECTIVE WATER MANAGEMENT IN COLORADO,
Colorado State Univ., Fort Collins.
L. L. Marcum.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 569, Price codes: A07 in paper copy, A01 in microfiche. MA Thesis, 1978. 134 p, 8 ref, 3 append. OWRT A-029-COLO(1).

Descriptors: *Institutions, *Administration, *Water law, *Colorado, Legal aspects, Constitutional law, Interstate compacts, Legislation, Decision making, Political aspects, Economic impact, Social impact, Surveys.

Institutional changes having the potential for improving water management in Colorado are discussed. Fourteen hypotheses concerning the political, economic and social factors contributing to the present state of the Colorado water system are presented and analyzed. The historical development of Colorado water institutions is summarized, and Colorado constitutional provisions, statutes, lead court cases, and interstate compacts dealing with water and water management are reviewed. The impact of Federal water agencies on the Colorado system is analyzed. It was concluded from the interviews concerning the hypotheses that local decision making is preferred to centralized state determinations, and that individual decision making is preferred to governmental decision making. (Davison-IPA)
W79-04503

FEDERAL WATER POLLUTION CONTROL ACT: THE SECTIONS 316 (A) AND 316 (B) PROCESS,
National Marine Fisheries Service, Ann Arbor, MI. National Power Plant Team.
E. S. Fritz.
Report No. FWS/OBS-76/20.5, August 1978. 15 p, 5 fig, 7 ref.

Descriptors: *Federal Water Pollution Control Act, *Thermal pollution, *Adjudication procedures, Effluent streams, Electric powerplants, Steam, Cooling towers, Environmental effects, Technology, Permits, Legal aspects, Pollutants, Water pollution sources, Water pollution abatement, Water quality, Water quality control.

The sections of the Federal Water Pollution Control Act Amendments of 1972 which pertain to thermal discharges and steam electric powerplants are described. Section 316 (a) provides for the modification of effluent limitations and standards of performance for thermal discharges. Section 316 (b) requires that the location, design, construction, and capacity of cooling water intake structures represent the best technology available for minimizing adverse environmental impacts. The provisions of the act are implemented through the NPDES permit system. The act requires that intake and discharge impacts be distinguished although the two are inseparable. Schematic flow charts illustrate the process and adjudacatory procedures; planning and submission of 316 (a) demonstration; planning and submission of 316 (b) studies for existing intake structures; studies for new source intake structures; and studies for new intake (not new source) structures. The adjudication process and the Fish and Wildlife Service role in implementing the act are outlined. (Davison-IPA)
W79-04507

METHODOLOGY FOR DESIGNING COST-EFFECTIVE MONITORING AND COMPLIANCE STRATEGIES FOR PESTICIDE USE,
CONSAD Research Corp., Pittsburgh, PA.
For primary bibliographic entry see Field 6A.
W79-04524

POLLUTION CONTROL GUIDANCE FOR GEOTHERMAL ENERGY DEVELOPMENT,
Industrial Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W79-04530

PROBLEMS OF PUBLIC ACCESS TO WATER IN TEXAS LAKES AND STREAMS: AN ANALYSIS,
Texas Tech Univ., Lobbock. Dept. of Geography
O. W. Templer.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 503, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, Texas Tech University Project Completion Report January 1979. 125 p, 2 fig, 142 ref. OWRT A-042-TEX(1). 14-34-0001-092. 14-34-0001-8046.

Descriptors: *Water law, Water rights, *Public access, Stream beds, *Texas.

This report examines the problems surrounding public access to the state-owned waters of Texas' lakes and streams, one of the most poorly understood areas of water and property law. Limited access to public water resources is becoming an increasingly serious problem as the state's rapidly growing populace seeks to avail itself of water-based recreational opportunities. The development of water and land law relating to public access is reviewed. Texas' complex water law history, combining diverse Hispanic-Anglo elements, along with the general absence of public land, make comparisons with other jurisdictions difficult. Unlike Gulf coastal waters and beaches, there is no express statutory recognition of the right of public access to inland waters. However, a number of cases do recognize the right for a variety of purposes; but because most of the law turns on the unique fact situations of each case, it is impossible to develop generally applicable legal principles. The problems of determining navigability and stream bed ownership in the context of Texas' statutory definition are reviewed, as are the even more tenuous rights of public use of banks and shores of navigable waterways. Once public access is attained, numerous impediments such as fences, dams, etc., often confront the would-be recreationist. Such obstacles are illustrated and discussed, as are the spatial aspects of access sites. Finally, unsuccessful alternatives which might have solved some of the recurrent problems are examined. Short of currently unacceptable comprehensive legislation, there are few measures to help resolve the growing controversy between the recreation-seeking public and private landowners in Texas. W79-04555

PUBLIC PERCEPTIONS OF ISSUES AND PROBLEMS IN THE LAKE CHAMPLAIN BASIN AREA, A SUMMARY,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 2H.
W79-04558

WATER LAW - RIGHTS OF IMPORTERS AND DEVELOPERS OF WATER. CITY AND COUNTY OF DENVER V. FULTON IRRIGATING DITCH CO., 506 P.2D 144 (COLO. 1972),
Wyoming Univ., Laramie. Water Resources Research Inst.; and Wyoming Univ., Laramie. Coll. of Law.
O. B. Riggs.
Land and Water Law Review, Vol. 9, No. 2, p 543-552, 1974. OWRT A-003-WYO(7), 14-31-0001-0051.

Descriptors: *Water law, *Water rights, *Colorado, *Diversion, Colorado River, Legal aspects, Imported water, *Denver(Colo).

The City and County of Denver obtains water from the Colorado River Basin by means of a transmountain diversion. After being used by Denver the water is treated and released into the South Platte River above the headgates of the defendant ditch company. In an action brought by Denver which sought approval for the sale of the imported water, the Colorado Supreme Court held that the city could re-use or make successive use of water which it had imported and that it could dispose of such water after use. Consequently, appropriators from the South Platte acquired no rights in the imported water unless such rights were acquired under a contractual arrangement with the importer. The law regarding rights inhering in imported water and the problems encountered in identifying such water are discussed. In addition, the economic and environmental implications of the legal doctrines regarding the re-use of water are explored.
W79-04594

LEGAL PROBLEMS IN CHANGING USES OR COORDINATING USES OF KEYHOLE RESERVOIR,
Wyoming Univ., Laramie. Water Resources Research Inst; and Wyoming Univ., Laramie. Coll. of Law.
K. D. Wagner.
Land and Water Law Review, Vol. 9, No. 2, p 485-506, 1974. OWRT A-003-WYO(6), 14-31-0001-4051.

Descriptors: Wyoming, *Reservoirs, Irrigation water, Supplemental irrigation, *Recreation, Legislation, Legal aspects, Keyhole Reservoir(Wyo).

Keyhole Dam and Reservoir, in northeastern Wyoming was constructed by the Bureau of Reclamation for purposes of providing supplemental water for irrigation as well as flood protection. Although irrigators have not taken advantage of the available water supply from Keyhole, extensive use has been made of the facility for recreational purposes. These recreational uses and potential industry use of water conflict with the authorized utilization of Keyhole. The various means by which the authorized uses of the reservoir may be changed or coordinated are explored. The authorizing legislation for the project and the administrative powers of the Bureau of Reclamation are discussed. Possible solutions for resolving the user conflict are outlined and the procedural ramifications are explored. Emphasis is placed on the possibilities for mutual water administration to accommodate the various uses, alternative supplies, purchase of water by the state, and changing the authorizing legislation.
W79-04595

AN ANALYSIS OF PLAYA LAKE WATER UTILIZATION ON THE TEXAS HIGH PLAINS,
Texas Tech Univ., Lubbock. Dept. of Geography.
O. W. Templer.
Water Resources Bulletin, Vol. 14, No. 2, p 454-465, April 1978. 3 fig, 34 ref. OWRT-A-029-TEX(2), 14-31-0001-5044 & 6045.

Descriptors: *Playas, *Lakes, *Water law, *Water utilization, Hydrographs, Ogallala formation, Water rights, High Plains(Texas).

Examined are the spatial, temporal and legal aspects of playa lake water utilization on the semi-arid Texas High Plains. These small basins of interior drainage collect and briefly hold an estimated two to three million acre-feet of runoff water annually, representing from one-fourth to one-third the quantity of groundwater pumped from the dwindling Ogallala aquifer. Once considered a detriment to farming operations, there is now increased interest in using playa water more effectively. At present, direct pumping is the chief method of utilization, and modification of lake bottoms to concentrate runoff and reduce evaporation is the most widespread conservation practice. The use of playa water for groundwater recharge is hampered by as yet unsolved technical problems. For many years the question of ownership of playa water remained unsettled. The Texas Water Rights Commission now classes it as diffused surface water, which under Texas law may be used by the landowner, though some legal problems remain. For playa lakes to be effectively integrated into the regional water resource, it becomes imperative that all present and prospective water utilization problems be identified and resolved. (Bell-Cornell)
W79-04611

SPECULATIVE POLICY MAKING IN THE ENVIRONMENTAL ARENA,
West Virginia Univ., Morgantown. Dept. of Political Science.
D. C. Menzel, and D. G. Williams.
Water Resources Bulletin, Vol. 14, No. 2, p 374-383, April 1978. 4 tab, 5 ref. OWRT A-032-WVA(1), 14-34-0001-7104.

Descriptors: *Water policy, West Virginia, Environment, Water law, Assessment, Legislation, Agencies, Reorganizaton, Political aspects, Institutions, Decision making.

The development of policy in the American political system has been characterized by incremental change, creation of support, bargaining, compromise, pluralistic group interplay, development of social and political support, technical input, review, and consideration. Incrementalism allows policy to develop in tandem with technical knowledge, legislative and executive support, political advantage, and presumably greater certainty concerning the impact of a particular choice. Environmetal policy development, one scholar has hypothesized, followed this basic pattern until the late 1960's when policy aspirations began to escalate much faster than the knowledge, organizational arrangements and political support upon which policy implementation depends. This 'escalation' hypothesis is examined herein, with particular attention given to policy development in West Virginia. (Bell-Cornell)
W79-04613

INTERNATIONAL PROBLEMS,
M. B. Holburt.
In: Values and Choices in the Development of the Colorado River Basin, The University of Arizona Press, Tucson, Arizona, 1978, p 220-237. 2 fig, 1 tab, 11 ref.

Descriptors: *Colorado River, Colorado River Basin, Water pollution control, Mexican Water Treaty, Legislation, Salinity.

This paper discusses the Colorado River water quality and quantity problems between the United States and Mexico, considerations that have led to the several agreements between the two countries and possible future actions. (Skogerboe-Colorado State)
W79-04660

ENVIRONMENTAL CONSIDERATIONS IN THREE INFRASTRUCTURE PLANNING AGENCIES: AN OVERVIEW OF RESEARCH FINDINGS,
Stanford Univ., CA. Dept. of Civil Engineering.
L. Ortolano, C. M. Brendecke, J. E. Price, and J. J. Meersman.
Report No. IPM-6, December 1978. 100 p, 1 tab, 34 ref, 4 append. NSF PRA-75-22340.

Descriptors: *Planning, *Project planning, Bureau of Reclamation, Army Crops of Engineers, Department of Transportation(California), Environmental effects, Institutions, Data transmission.

Research is reported which tests a priori hypotheses concerning relationships between the influence of environmental information on planning results, and aspects of planning grouped as follows: organizational design; coordination with other agencies and the public; timing of environmental studies and coordination; and the attitudes of planners. The hypotheses were tested using data from interviews with 118 planners and environmental specialists who were instrumental in water resources and highway planning investigations carried out by the U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers, and the California Department of Transportation. The most strongly supported hypotheses were those indicating that environmental information strongly influences planning outcomes in studies where: (1) early and extensive coordintion exists between agencies and the public; and (2) environmental specialists function as active planners communicating frequently with engineering planners, and whose duties include a broad range of activities besides environmental impact assessment. (Davison-IPA)
W79-04680

LAKE STURGEON POPULATIONS, GROWTH, AND EXPLOITATION IN LAKES POYGAN, WINNECONNE, AND LAKE BUTTE DES MORTS, WISCONSIN,

Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 6G.
W79-04755

WATER-ORIENTED OUTDOOR RECREATION IN THE ILLINOIS RIVER BASIN (APPENDIX VI)--ILLINOIS-INDIANA-WISCONSIN.
Bureau of Outdoor Recreation, Philadelphia, PA. Northeast Regional Office.
For primary bibliographic entry see Field 6B.
W79-04853

WATER MANAGEMENT POLICIES AND INSTRUMENT.
Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 5G.
W79-04856

THE RIVER'S REACH: A UNIFIED PROGRAM FOR FLOOD PLAIN MANAGEMENT IN THE CONNECTICUT RIVER BASIN.
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 4A.
W79-04857

REPORT OF THE DENVER WORKSHOP ON STATE-LOCAL-FEDERAL RELATIONSHIPS IN SOCIOECONOMIC IMPACT ASSESSMENT,
Denver Research Inst., CO. Industrial Economics Div.
For primary bibliographic entry see Field 6B.
W79-04858

A FEASIBILITY STUDY FOR DEVELOPING A RESERVOIR ON BIG COW CREEK, NEWTON COUNTY, TEXAS.
Sabine River Authority of Texas, Orange; and Henningson, Durham and Richardson, Inc., Henderson, TX.
For primary bibliographic entry see Field 6B.
W79-04867

WATER POLICY AND DECISION-MAKING IN THE COLORADO RIVER BASIN,
California Univ., Santa Barbara. Dept. of Political Science.
D. E. Mann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 025, Price codes: A04 in paper copy, A01 in microfiche. National Science Foundation, Research Applied to National Needs, Lake Powell Research Project Bulletin No. 24, July 1976. 56 p, 55 ref. G134840.

Descriptors: *Water quality, *Water supply, *River basin development, *Water resources, *Water policy, *Lake Powell(CO), *Colorado River Basin, Energy, Environmental effects, Water treatment, Economic development, Decision-making, Planning, Mexico, Redistribution, Politics, Environmental management, Energy resources.

Water quality in the Colorado River Basin is a crucial issue because of increasing salinity, the Mexican demands for better quality water, and new legislation pertaining to water quality standards. This report discusses the water policy and decision-making process in the Basin, the energy issue as it relates to water policy, and future policy and decision-making issues. It examines the extent to which traditional patterns of decision-making may be changing in light of new policy considerations. The Mexican demand for improvements in the quality of the water it receives conflicts with the energy policy because the development of energy resources will increase the pollution problem. The report describes the Salinity Control Program, the setting in which it was developed, and how the energy issue complicates the goals of the program. Energy development in the region is accepted by both the public and its leaders, but there is concern regarding the environmental consequences. The impacts of energy development on the region are analyzed. The traditional decision-making process for water policies is described as distributive and this framework is discussed. Future developments may alter the framework to one of 'regulatory' or 'redistributive' and the consequences of this shift are discussed. (Coan-NC)
W79-04868

IMPROVEMENTS NEEDED IN THE CORPS OF ENGINEERS' REGULATORY PROGRAM FOR PROTECTING THE NATION'S WATERS.
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6B.
W79-04871

WATER BANKING: HOW TO STOP WASTING AGRICULTURAL WATER,
California Univ., Berkeley. Graduate School of Public Policy.
For primary bibliographic entry see Field 3F.
W79-04875

WATER QUALITY PLANNING IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Regional Planning.
D. H. Moreau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 970, Price codes: A03 in paper copy, A01 in microfiche. July 1977. 30 p, 7 fig, 2 tab.

Descriptors: *Water quality planning, *Water resources development, *Waste treatment, *Water quality standards, *Water policy, *Water quality control, *North Carolina, *Stream classification, River basins, Resource management, Water pollution, Land use planning, Effluents, Regulation, Government, Planning, Water law, Federal Water Pollution Control Act of 1972.

An historical glimpse of North Carolina's water quality planning efforts and an assessment of contemporary efforts at water supply and water quality planning are discussed. The first efforts to protect public drinking water supplies were in 1903 when the N.C. State Board of Health was charged with the responsibility of developing a regulatory program to protect public water supplies. These efforts were intensified in the post-World War I era when growing industrial and population demands strained water resource capabilities. The first comprehensive assessment of waste water discharges published in 1947 by the State Stream Sanitation and Conservation Committee are described. This committee had no regulatory authority over discharges into streams. In 1951, the first comprehensive pollution control legislation was passed, consisting of 4 major elements: (1) development of water quality standards based on stream use; (2) surveys of existing pollution and water quality in major river basins; (3) classifications of streams according to best use; and (4) formulation of comprehensive pollution abatement plans based on stream classification and water quality standards. Present attempts at water quality planning arise from the State's response to the FWPCA 1972 (PL92-500). This three-tiered approach to water quality planning is described in depth: river basin planning, areawide planning, and facilities planning. The present organizational structure of State water resource planning and major constraints to effective planning are also offered. (Coan-NC)
W79-04922

ANALYSIS OF ALASKA'S WATER USE ACT AND ITS INTERACTION WITH FEDERAL RESERVED WATER RIGHTS,
Alaska Univ., Fairbanks. Arctic Environmental Information and Data Center.
H. J. Curran, and L. P. Dwight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 061, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Resources, University of Alaska Publication No. 98. February 1979. 33 p, 34 ref. OWRT A-059-ALAS(1), 14-34-0001-7003.

Descriptors: *Water law, *Prior appropriation, *Water permits, *Water policy, *Water rights, Legal aspects, Riparian rights, Wildlife management, Alaska, Minimum stream flows.

Since the passage of Alaska's Water Use Act in 1966, the amount of water required by Alaska's growing population and resource development has increased very rapidly. The need to review the adequacy of existing water use laws and their administration has been expressed both by those trying to comply with regulations and by those attempting to enforce standards and permit requirements. The historical development of the doctrine of prior appropriation in Alaska is summarized. The statutory authority, regulations, and administration of Alaska's Water Use Act by the Alaska Department of Natural Resources are presented. Overlapping state agency authorities are discussed, and existing and proposed regulations are analyzed. The application of federal reserved water rights to Alaska and the status of quantification of these rights is explained. Options are presented for the State of Alaska to manage water use on federal lands, and for preserving minimum stream flows for maintenance of fish and wildlife habitats.
W79-04959

INSTITUTIONAL CHANGE AND FIRE MANAGEMENT,
California Univ., Berkeley. Dept. of Forestry and Conservation.
R. G. Lee.
In: Proceedings of the Symposium on the Environmental Consequences of Fire and Fuel Management in Mediterranean Ecosystems, August 1977, USDA Forest Service General Technical Report WO-3, p 202-214, 4 fig. (CA. Water Resources Center Project UCAL-WRC-W-499). OWRT-A-058-CAL(2).

Descriptors: *Fire, *Forest management, *Burning, Social aspects, Social change, Institutions, Organizations.

This paper examines how social organization facilitates control over wildfire. A theory of institutional change is used to interpret the history of social organizational efforts to regulate fire in California's wildlands. Three types of institutions are described: (1) local volunteers that provided the primary means for fuel and fire management in the first eight years of that state, (2) fire control bureaucracies that have provided fire protection for the last fifty years, and (3) possible new organizational means for integrating fire and fuel management with other land management activities. It is concluded that, in addition to more scientific and technical knowledge, institutional changes will require new commitments by individuals and the realignment of organizations with new interests. (Snyder-Calif.-Davis)
W79-04966

ENVIRONMENTAL AND INSTITUTIONAL ASPECTS OF IRRIGATION AGRICULTURE,
Science and Education Administration, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 3F.
W79-04978

6F. Nonstructural Alternatives

METHODOLOGY FOR EVALUATION OF FEASIBILITY: MULTIJURISDICTIONAL URBAN DRAINAGE AND FLOOD CONTROL PROJECTS.
Urban Drainage and Flood Control District, Denver, CO
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 576, Price codes: A04 in paper copy, A01 in microfiche. Report February 1977. 63 p, 13 fig, 8 tab, 7 ref, 2 append. OWRT B-113-COLO(11).

Descriptors: *Flood control, *Urban drainage, Feasibility, Project planning, Flood plains, Management, Evaluation, Colorado, Cost-benefit analysis, Damages, Tangible benefits, Intangible benefits, Drainage districts, Drainage programs.

A methodology enabling engineers to evaluate the feasibility of urban drainage and flood control (UDFC) projects is reported. Currently, interest is increasing in nonstructural solutions to flooding. In addition to providing better land use plans and flood plain management, nonstructural programs allow more efficient use of public funds. Historically, UDFC projects have emphasized reducing and preventing property damage. Twelve proposed objectives for flood control in the Denver area to be considered in a feasibility study are presented. The methodology is divided into three parts: (1) a technique for comparing the costs and benefits of UDFC projects on the basis of damage reduction; (2) techniques for displaying descriptive information concerning all other project benefits; and (3) a tradeoff analysis. A multijurisdictional case study based on the Little Dry Creek Master Plan project is examined and discusse. (Davison-IPA)
W79-04502

PUBLIC PERCEPTIONS OF ISSUES AND PROBLEMS IN THE LAKE CHAMPLAIN BASIN AREA, A SUMMARY,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 2H.
W79-04558

PLANNING STORM-DRAINAGE SYSTEMS FOR URBAN GROWTH,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
A. A. Dendrou, J. W. Delleur, and J. J. Talavage.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. WR1, p 7-16, November 1978. 10 fig, 1 equ, 19 ref. OWRT-B-083-IND(8).

Descriptors: *Urban hydrology, *Simulation analysis, *Urban runoff, Zoning, Planning, Drainage, Floods, Model studies, Systems analysis, On-site storage, Nonstructural alternatives, Storm water runoff, Urbanization.

A package is developed that integrates and interfaces an urban growth simulation model and an urban hydrology model, so as to explicitly evaluate the effectiveness of nonstructural measures, e.g., zoning as far as the drainage system is concerned. Alternate growth scenarios can thus be directly related to the corresponding storm-drainage systems of specified standards of performance. Among the remaining 'Best Management Practice' control options, the on-site storage, treatment and controlled overflow are retained as accurately representing the facets of urban storm-water management relevant at the planning stage. This is achieved by including these controls in a simulation of the hydrologic behavior of each local drainage basin of an urban agglomeration separately. An application is made for a medium size community in Indiana. (Bell-Cornell)
W79-04618

G. Ecologic Impact Of Water Development

INFLUENCE OF TURBIDITY ON FISH ABUNDANCE IN WESTERN LAKE SUPERIOR,
Wisconsin Univ.-Superior. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-04532

TUBERCULATION OF PEARL DACE, SEMOTILUS MARGARITA (PISCES: CYPRINIDAE),
Maryland Univ., College Park. Center of Environmental and Estuarine Studies.
A. Fava, and C-f. Tsai.
Copeia, No. 2, p. 370-374, May 17, 1976. 1 fig, 2 tab, 7 ref. OWRT B-006-MD (8).

Descriptors: *Fish, *Fish pysiology, *Fish reproduction, Growth stages, Fish behavior, Spawning, Biorhymthms, Ecology, Pearl dace, Hamilton Run(Maryland).

The breeding tuberoles of S. margarita and their seasonal development are described. A breeding male and a breeding female were selected for tubercular measurement, and the mean length and diameter of the tubercles on each part of the body and fins were calculated by measuring about five tubercles with an ocular micrometer under the dissection microscope. Tubercles are present almost completely over the head and body of the breeding male, and are more widely distributed over the body of this species than in other species of Semotilus. On the breeding female, tubercles are much less developed than on males. The developed than on males. The development of breeding tubercles of this species parallels gonadal maturation. Development in males begins in November, and the tubercles reach their greatest size and number from March through May. After spawning there is a rapid loss of tubercles, and in June no males had them. In females the development of tubercles begins later than in males, and disappear more quickly. The biological significance of the breeding tubercles as related to breeding behavior is described. (Davison-IPA)
W79-04663

WATER IN LAND USE PLANNING.
New Mexico Wate Resources Research Inst., Las Cruces.
For primary bibliographic entry see Field 6A.
W79-04681

LAKE STURGEON POPULATIONS, GROWTH, AND EXPLOITATION IN LAKES POYGAN, WINNECONNE, AND LAKE BUTTE DES MORTS, WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
G. R. Priegel, and T. L. Wirth.
Technical Bulletin, No 107, 1978. 23 p, 12 fig, 14 tab, 11 ref.

Descriptors: *Wisconsin, *Lake sturgeon, *Lake Poygan(WI), *Lake Winneconne(WI), *Lake Butte des Morts(WI), *Fish management, *Sport fishing, *Spear fishing, *Regulation, Commercial fishing, Lake Winnebago, Acipenser fulvescens, Lakes, Creel census, Fish populations, Fish conservation, Fisheries, Productivity, Wildlife management.

Lake sturgeon (Acipenser fulvescens) in Lakes Poygan, Winneconne, and Butte des Morts, part of Wisconsin's Lake Winnebago chain, declined 1952-76. Overharvest is indicated by: (1) decrease in number of fish speared per fisherman, (2) increase in the harvest of sturgeon under 50 in., (3) decrease in the harvest of larger size classes, (4) a downward trend in the age of harvested fish, (5) changes in mortality rates, and (6) increase in number of ice fishing shanties counted on the lakes. Throughout their range in the U.S. and Canada lake sturgeon populations are markedly reduced and support commercial or sport fisheries in only a few areas; the largest sport fishery is in Lake Winnebago (which is not overfished) and in the three upriver study lakes. Since 1952 only spear fishing has been allowed, and the minimum length has been increased from 30 in. in 1952 to 45 in. in 1974; bag limit was reduced to one fish in 1957, with the minimum fishing age set at 16. The annual 16-day season in 1952 was gradually reduced to the current two days every five years (1976 was the most recent season). Probably inaccurate creel census estimates of total harvest were 200 in 1952, 784 in 1953, and 879 in 1954. Estimates since 1955 based on registrations showed a high of 715 in 1955 and a low of 80 in 1968; the harvest was 227 in 1971 and 85 in 1976. Lake Poygan now accounts for 99% of fish speared on the upriver lakes. Management alternatives include maintenance of the present season, limiting fishing pressure, and regulation through minimum size limits. (Lynch-Wisconsin)
W79-04755

A FEASIBILITY STUDY FOR DEVELOPING A RESERVOIR ON BIG COW CREEK, NEWTON COUNTY, TEXAS.
Sabine River Authority of Texas, Orange; and Henningson, Durham and Richardson, Inc., Henderson, TX.
For primary bibliographic entry see Field 6B.
W79-04867

RECREATIONAL BOATING ON THE TIDAL WATERS OF MARYLAND. A MANAGEMENT STUDY.
For primary bibliographic entry see Field 6B.
W79-04876

AN EVALUATION OF THE EFFECTS OF GEOTHERMAL ENERGY DEVELOPMENT ON AQUATIC BIOTA IN THE GEYSERS AREA OF CALIFORNIA,
California Univ., Berkeley. Div. of Entomology and Parasitology.
V. H. Resh, T. S. Flynn, G. A. Lamberti, and E. McElravy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 031, Price codes: A04 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis. Technical Completion Report, February 1979. 59 p, 5 fig, 7 tab. (California Water Resources Center Project UCAL-WRC-W-519), OWRT-A-063-CAL(1).

Descriptors: Caddisflies, *Geepers, *Thermal water, *Hot springs, *Stream, *Aquatic life, Aquatic insects, Biological communities, California.

The Geysers of Sonoma County, California, currently the largest geothermal energy field in the world, is expected to expand its electrical generating capacity considerably in the coming years. However, these future developments may result in watershed modification and potentially deleterious effects on aquatic biota due to the topography of this area. Analysis of the response of benthic populations and communities to past and ongoing geothermal energy development and operational practices was undertaken by means of an extensive six site sampling program on Big Sulfur Creek and a concentrated colonization study above, in, and on Big Sulfur Creek and a concentrated colonization study above, in, and below a heavily impacted tributary (Little Geysers Creek). Differences in species diversity were noted among the six Big Sulfur Creek sites that were selected relative to the presence or absence of natural fumaroles or hot springs and the absence or stage of geothermal energy development. Distribution and colonization patterns of a population of sericostomatid caddisfly, Gumaga nigricula, and especially its dominance in high silt areas, suggest that both siltation and fumarole activity may select for certain populations. (Snyder-Calif. Davis)
W79-04962

7. RESOURCES DATA

7B. Data Acquisition

ENHANCEMENT OF WATER-QUALITY MONITORING SYSTEMS BY INCORPORATING WATER-QUALITY MODELLING AND TIME-SERIES ANALYSIS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 5B.
W79-04571

THE WATER WITCH: FACT . . . OR FICTION.
P. Call.
Pacific Groundwater Digest, Vol. 2, No. 1, p 30-35, January 1979.

Descriptors: *Dowsing, *Groundwater, *Drilling, Water wells, Exploration.

Despite the fact that dowsing is being given serious consideration in scientific circles and that modern dowsers are successful, respected businessmen, they are still considered fakes by many people in the drilling industry and by hydrogeologists. The U.S.G.S. concluded that further tests to establish the validity of dowsing were not justified. Jay Lehr, the executive director of the National Water Well Association, states that dowsers are partly to blame for the fact that out ground water resources are underdeveloped. Wayne Thompson, one of the trustees of the American Society of Dowsers, feels that dowsing is an equally good alternative to geology in locating water and that there is not much conflict between geologic theory and dowsing theory. The vein concept od dowsers, in geologic terms, would be an area which is more permeable than the surrounding region and through which groundwater tends to flow. Not everyone can dowser and even successful dowsers occassionally miss. Modern dowsers are questioning their abilities and looking for science and technology for answers. Dowsing has gone hand in hand with the water well industry for centuries and it is as widely practived as it ever was. Whether fact or fiction, dowsing is her to stay. (Purdin-NWWA)
W79-04578

SEWER NETWORK SCHEME FOR DIGITAL COMPUTATIONS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W79-04590

THE APPLICATION OF OPTIMAL LINEAR REGULATOR THEORY TO A PROBLEM IN WATER POLLUTION,
Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
C. B. Winn, and J. B. Moore.
IEEE Transactions of Systems, Man, and Cybernetics, Vol. SMC-3, No. 5, p 450-455, September, 1973. 7 fig, 9 ref. OWRT-C-2207(3410)(11), 14-31-0001-3410.

Descriptors: *Model studies, Water pollution, Sewerage, *Combined sewers, *Treatment facilities, Standards, Overflow, Storage capacity, *Control systems, *Waste water treatment, Regulators.

A model has been developed with the objective of utilizing the total storage capacity available in the system in such a manner as to minimize water pollution resulting from overflows at individual points within the system. In addition, it is required that no abrupt changes in control be admitted, as this is likely to lead to undesirable surges. The nonlinear model is shwon to fit within the framework of an optimal regulator problem with derivative constraints. The optimal feedback control law is derived and compared with the optimal bang-bang controller. The solution technique that is presented may be applied to many combined storm-sewer systems in which the flows through the systems to the treatment plants may be controlled. It may be used by municipal engineers to determine necessary modifications to existing systems so as to meet new water pollution standards. (Sandoski-FIRL)
W79-04596

BIOLOGICAL SURVEILLANCE OF RIVERS: A BIOLOGICAL MONITORING HANDBOOK,
Water Pollution Research Lab., Stevenage. (England).
J. M. Hellawell.
Water Research Centre, Stevenage, Herts. 1978. 332 p.

Descriptors: *Rivers, *Biology, *Monitoring, Water quality, Water pollution, Surveys, Water quality standards, Sampling, Invertebrates, Fish, Aquatic animals, Benthic fauna, Aquatic microorganisms, Biota, Bibliographies, On-site investigations, Data processing, Aquatic microbiology, Biological communities.

This 10-chapter monograph deals with water quality and pollution surveys, including monitoring objectives, water standards and criteria, field surveys, sampling strategies (for macroinvertebrates, fish, benthic organisms, macrophytes, etc.), data analysis and biotic indices, comparisons of data-handling methods, presentation and interpretation of survey results, and sources of additional help (keys for taxa identification, mathematical tables, bibliographic references, etc.). (Brown-IPC)
W79-04634

PESTICIDE TRANSPORT AND METABOLISM IN MODEL SYSTEMS,
Agricultural Research Service, Beltsville, MD. Pesticide Degradation Lab.
For primary bibliographic entry see Field 5B.
W79-04661

SOLAR ENERGY INFORMATION AND DATA FOR ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W79-04719

ON THE DETECTION OF SHALLOW AQUIFERS USING THERMAL INFRARED IMAGERY,
Connecticut Univ., Storrs. Dept. of Geology and Geophysics.
D. Huntley.
Water Resources Research, Vol. 14, No. 6, p 1075-1083, December 1978. 11 fig, 21 ref. NASA NGL 06-001-015.

Descriptors: *Remote sensing, *Aquifers, *Infrared radiation, Temperature, Heat flow, Thermal radiation, Theoretical analysis, Laboratory tests, On-site investigations, Simulation analysis, Mathematical models, Model studies, Groundwater, Soil water, Soils, Soil moisture, On-site data collections, Thermal inertia, Shallow aquifers.

Patterns appearing on a thermal infrared image are primarily a function of the temperature of the earth's surface. Diurnal surface temperatures are affected by the thermal inertia and solar reflectance of the surface, by meteorologic variables, by evaporation rates, and by subsurface temperature effects such as the effect due to varying groundwater depth. Variations in surface material result in variations in both thermal inertia and solar reflectance, causing a change in both the magnitude of temperatures through the diurnal cycle and the amplitude of diurnal temperature variation. Variations in soil moisture result in similar effects and, in addition, result in a change in evaporative cooling rates. Variation in groundwater depth produces an effect on surface temperature that is discriminable from variations in solar reflectance and thermal inertia but is not discriminable from variations in evaporative cooling rates. (Sims-ISWS)
W79-04745

SATELLITE SNOW-COVER OBSERVATIONS IN ARIZONA,
Geological Survey, Phoenix, AZ. Water Resources Div.
H. H. Schumann.
In: Proceedings of the American Society of Photogrammetry Fall Technical Meeting, Albuquerque, New Mexico, October 15-20, 1978, p 480-489, 1978. American Society of Photogrammetry, Falls Church, Virginia. 7 ref.

Descriptors: *Remote sensing, *Snow cover, *Snow surveys, *Photogrammetry, *Arizona, Mapping, *Salt-Verde watershed.

A variety of satellite imagery is available for operational snow-cover mapping in central Arizona. The high-resolution multispectral imagery acquired by satellites of the experimental Landsat series particularly is well suited for snow-cover mapping at the commonly used scale of 1:1,000,000. The use of Landsat imagery for operational monitoring of the rapid changes in snow-covered areas in central Arizona is limited by the cloud cover and by the once each 9-day coverage now available. (Woodard-USGS)
W79-04803

TIME-DEPENDENCE OF SEA-ICE CONCENTRATION AND MULTIYEAR ICE FRACTION IN THE ARCTIC BASIN,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center; and Geological Survey, Tacoma, WA. Water Resources Div.
P. Gloersen, H. J. Zwally, A. T. C. Chang, D. K. Hall, and W. J. Campbell.
Boundary-Layer Meteorology 13, p 339-359, 1978. 13 fig, 1 tab, 21 ref.

Descriptors: *Remote sensing, *Sea ice, *Ice-water interfaces, *Arctic, *Satellites(Artificial), Infrared radiation, Microwave images.

The time variation of the sea-ice concentration and multiyear ice fraction within the pack ice in the Arctic Basin is examined, using microwave images of sea ice recently acquired by the Nimbus-5 spacecraft and the NASA CV-990 airborne laboratory. The images used for these studies were constructed from data acquired from the Electrically Scanned Microwave Radiometer (ESMR) which records radiation from earth and its atmosphere at a wavelength of 1.55 cm. Data are analyzed for four seasons during 1973-1975 to illustrate some basic differences in the properties of the sea ice during those times. Spacecraft data are compared with corresponding NASA CV-990 airborne laboratory data obtained over wide areas in the Arctic Basin during the Main Arctic Ice Dynamics Joint Experiment (1975) to illustrate the applicability of passive-microwave remote sensing for monitoring the time dependence of sea-ice concentration (divergence). These observations indicate significant variations in the sea-ice concentration in the spring, late fall and early winter. In addition, deep in the interior of the Arctic polar sea-ice pack, heretofore unobserved large areas, several hundred kilometers in extent, of sea-ice concentrations as low as 50% are indicated. (Woodard-USGS)
W79-04811

MORPHOMETRY OF A TIDAL MOUTH, ACCORDING TO ITS DISCRETE MODEL,
For primary bibliographic entry see Field 2L.
W79-04950

RAPID DETERMINATION OF SOIL WATER CHARACTERISTIC BY THERMOCOUPLE PSYCHROMETRY,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W79-04987

7C. Evaluation, Processing and Publication

OCCURRENCE, QUANTITY, AND QUALITY OF GROUND WATER IN TAYLOR COUNTY, TEXAS.
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W79-04575

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN DAWSON AND BORDEN COUNTIES, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 225, November 1978. 70 p, 18 tab, 74 ref, 24 map.

Descriptors: *Groundwater resources, *Texas, *Aquifers, *Data collections, Groundwater, Maps, Water resources, Aquifer characteristics, Groundwater recharge, Water supply, Groundwater availability, Groundwater mining, Overdraft, Pumping, Projections, Saturated flow, Water wells,

*Dawson County(TX), *Borden County(TX), *Ogallala aquifer(TX), Pumpage rates, Pumping lifts, Well yields.

This is one of numerous planned county studies covering the declining groundwater resource of the Ogallala aquifer in the High Plains of Texas. The report contained maps, charts, and tabulations which reflect estimates to the volume of water in storage in the Ogallala aquifer in Dawson and Borden Counties and the projected depletion of this water supply by decade periods through the year 2020. Included were estimates of pumpage, pumping lifts, and other data related to current and future water use in the counties. However, the report did not attempt to project that portion of the volume of water in underground storage which may be ultimately recoverage. The Ogallala aquifer in Dawson and Borden Counties contained approximately 3.8 million acre-feet of water in 1974. Historical pumpage has exceeded 90,000 acre-feet annually, which is more than twice the rate of natural recharge to the aquifer in the counties. This overdraft is expected to continue, ultimately resulting in reduced well yields, reduced acreage irrigated, and reduced agricultural production. (Humphreys-ISWS)
W79-04576

SIMULATION OF URBAN NON-POINT SOURCE POLLUTION,
CH2M/Hill, Redding, CA.
For primary bibliographic entry see Field 5B.
W79-04609

PUBLIC GROUNDWATER SUPPLIES IN WARREN COUNTY,
Illinois State Water Survey, Urbana.
D. M. Woller, K. L. Kunz, and E. W. Sanderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 713, Price codes: A02 in paper copy, A01 in microfiche. Bulletin 60-25, 1978. 20 p, 2 fig.

Descriptors: *Water supply, *Illinois, *Groundwater resources, *Well data, Unconsolidated aquifers, Gravels, Sand aquifers, Bedrock, Sandstones, Dolomite, Groundwater availability, Groundwater, Water souces, Water quality, Water wells, Data collections, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquifers, Drillers logs, *Warren County(IL), Dissolved minerals, Water bearing formations.

All available information on production wells used for public groundwater supplies in Warren County, Illinois, was presented. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. The report included separate descriptions for 6 groundwater supplies furnishing water to 5 municipalities and 1 subdivision in Warren County. These descriptions were preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. Individual production wells for each supply were described in the order of the construction. The description for each well included the aquifer or aquifers tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)
W79-04720

A MATHEMATICAL DETERMINISTIC RIVER-QUALITY MODEL. PART 2: USE IN EVALUATING THE WATER-QUALITY MANAGEMENT OF THE BLACKWATER CATCHMENT,
Thames Water Authority, Reading (England).
For primary bibliographic entry see Field 5B.
W79-04722

OPTICS OF TURBID ESTUARINE WATERS: APPROXIMATIONS AND APPLICATIONS,
Hydroscience, Inc., Westwood, NJ.
For primary bibliographic entry see Field 1A.
W79-04734

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1977--VOLUME 1. MISSOURI RIVER BASIN, ARKANSAS RIVER BASIN, RIO GRANDE BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 258, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CO-77-1, November 1978. 369 p, 4 fig, 4 tab, 40 ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Missouri River basin, *Arkansas River basin, *Rio Grande basin.

Water-resources data for Colorado for the 1977 water year consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for 424 gaging stations, 5 partial-record flow stations, 79 crest-stage partial-record stations, and 193 miscellaneous sites; stage and contents of 25 lakes and reservoirs; water quality for 134 gaging stations and 60 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (Woodard-USGS)
W79-04790

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1977--VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 259, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CO-77-2, December 1978. 368 p, 4 fig, 4 tab, 41 ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Colorado River basin, *Dolores River.

Water-resources data for Colorado for the 1977 water year consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for 424 gaging stations, 5 partial-record flow stations, 79 crest-stage partial-record stations, and 193 miscellaneous sites; stage and contents of 25 lakes and reservoirs; water quality for 134 gaging stations and 60 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (Woodard-USGS)
W79-04791

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1977--VOLUME 3. DOLORES RIVER BASIN, GREEN RIVER BASIN, SAN JUAN RIVER BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Geological Survey Water-Data Report CO-77-3, December 1978. 412 p, 4 fig, 4 tab.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Dolores River basin, *Green River basin, *San Juan River basin.

Water resources data for Colorado for the 1977 water year consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for 424 gaging stations, 5 partial-record flow stations, 79 crest-stage partial-record stations, and 193 miscellaneous sites; stage and contents of 25 lakes and reservoirs; water quality for 134 gaging stations and 60 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (Woodard-USGS)
W79-04792

SUMMARY OF HYDROLOGIC DATA COLLECTED DURING 1976 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. E. Hull.
Geological Survey open-file report 78-883, October 1978. 83 p, 57 fig, 8 tab, 16 ref.

Descriptors: *Hydrologic data, *Water quality, *Surface waters, *Groundwater, Canals, Saine water intrusion, Discharge(Water, Water yield, Water level fluctuations, Hydrographs, Aquifers, Water utilization, Florida, *Dade County.

During 1976 rainfall was 1.58 inches below the long-term average. Ground-water levels ranged from 0.4 foot above to 0.5 foot below average. The highest and lowest ground water for the year were both 1 foot below their long-term averages. In the Hialeah-Miami Springs area, water levels in wells near the centers of the heaviest pumping ranged from 8.0 to 9.5 feet below msl (mean sea level, 1929); and in the southwest well-field area, groundwater levels near the centers of pumping ranged from 2.0 feet above to 3.0 feet below msl. The combined average daily discharge from nine major streams and canals that flow eastward into tidal waters was 1,666 cubic feet per second (cfs), 609 cfs above the combined average daily flow for the 1975 water year. The combined average daily flow through the Tamiami Canal outlets was 783 cfs, 215 cfs above that of the 1975 water year. The 1976 position of the salt fron in the coastal part of the Biscayne aquifer was about the same as in 1975 except in the vicinity of Mowry Canal south of Homestead Air Force Base where the salt front had encroached farther inland. (Woodard-USGS)
W79-04795

PENNSYLVANIA ANNUAL PROGRESS REPORT, 1978,
Geological Survey, Harrisburg, PA. Water Resources Div.
D. R. Miller.
Geological Survey Pennsylvania District Report, 1978. 91 p.

Descriptors: *Water resources, *Projects, *Annual, *Reviews, *Pennsylvania, Surface waters, Groundwater, Water quality, Streamflow, Gaging stations, Reservoirs, Water wells, Water

supply, Land use, Water utilization, Mapping, Sampling, Sites, Urbanization, Water pollution, Publications, Bibliographies, *Annual summary report.

This report describes the projects, the accomplishments, and the activities of the Water Resources Division of the Geological Survey resources programs over the 1978 fiscal year in the Commonwealth of Pennsylvania. The diversification of the projects reflects the growth and the national interests of the United States. They show the problems and challenges that present-day managers, developers, and users of water face in these times of natural resources conflicts. The Commonwealth and Nation are making every effort to solve the problems of energy, environment, economy and urbanization. (Woodard-USGS)
W79-04797

WATER RESOURCES AND GEOLOGY OF THE SPRINGFIELD AREA, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div; and Missouri Dept. of Natural Resources, Rolla. Div. of Geology and Land Survey.
L. F. Emmett, J. Skelton, R. R. Luckey, D. E. Miller, and T. L. Thompson.
Missouri Department of Natural Resources, Water Resources Report No. 34, 1978. 150 p, 35 fig, 4 plates, 22 tab, 4 ref, 2 append.

Descriptors: *Surface-groundwater relationships, *Groundwater availability, *Groundwater potential, *Water sources, *Computer models, Base flow, Karst hydrology, Groundwater movement, Aquifers, Maps, Water supply, Wells, Potentiometric level, Low flow, Flood flow, Groundwater recharge, Water use, Reservoir storage, Runoff, Water quality, Geology, Urban runoff, Missouri, *Springfield area, Seepage run, Streamflow losses.

Two aquifers separated by dolomitic siltstone and shale, are present in the Springfield area, Missouri. The principal ground-water supply is the major aquifer, which consists of over 1,000 ft of dolomite of Cambrian-Ordovician age. The minor aquifer, which is as much as 300 ft thick, consists of cherty limestones of Mississippian age. Seepage runs were made during low and high base-flow conditions to locate stream reaches where losses occur. Losses to bedrock were defined in Pearson, Pickerel, and Terrell Creek basins. The quality of ground and surface water is generally good, but a potential for ground-water contamination does exist in the cavernous limestone terrane. Approximately 8.0 Mgal/d is withdrawn from the major aquifer. A digital model of the aquifer indicates that additional water can be withdrawn if users can tolerate additional lowering of a potentiometric surface. Present (1976) municipal water usage of 15 Mgal/d could be sustained during severe drought conditions with no additional sources required, but additional sources would be necessary by the early 1980's. (Woodard-USGS)
W79-04798

MAPS SHOWING FORMATION TEMPERATURES AND CONFIGURATIONS OF THE TOPS OF THE MINNELUSA FORMATION AND THE MADISON LIMESTONE, POWDER RIVER BASIN, WYOMING, MONTANA, AND ADJACENT AREAS,
Geological Survey, Cheyenne, WY. Water Resources Div.
W. J. Head, K. T. Kilty, and R. K. Knottek.
Geological Survey open-file report 78-905, November 1978. 12 p, 5 fig, 6 ref.

Descriptors: *Groundwater resources, *Hydrogeology, *Water temperature, *Maps, *Structural geology, Mapping, Profiles, Contours, Borehole geophysics, Geothermal studies, Regional development, Coal mines, Evaluation, Planning, Wyoming, Montana, *Powder River Basin.

This report is part of a study to describe the hydrogeologic framework needed to evaluate the water resources of the Paleozoic age aquifers in the Northern Great Plains coal region. Preliminary studies by the U.S. Geological Survey and State agencies in Wyoming, Montana, and South Dakota have indicated that these aquifers might provide a significant percentage of the water requirements for coal development. Geologic and water-temperature data for the Minnelusa Formation of Permian and Pennsylvanian age and for the Madison Limestone (Group where it is subdivided) of Mississippian and locally late Devonian age, and their equivalents, were compiled and interpreted. Maps were produced showing the altitude and groundwater temperatures of the top of these formations. The altitude (configuration) maps show the depth and position of the formations throughout the area. Temperature maps can be used to calculate changes in the viscosity of water caused by large temperature differences. The viscosity differences will be useful in adjusting calculated transmissivity aquifer values (the rate at which water can be transmitted through an aquifer). (Woodard-USGS)
W79-04799

WATER-QUALITY INVESTIGATION OF THE YELLVILLE WATERSHED, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb, and C. S. Williams.
Geological Survey open-file report 78-904, 1978. 17 p, 1 fig, 4 tab, 10 ref.

Descriptors: *Water quality, *Baseline studies, *Surface waters, *Groundwater resources, *Arkansas, Geology, Water analysis, Topography, Planning, *Presoil conservation program, *Yellville watershed, Town Branch.

The results of a 1-year study of surface-water quality in the Yellville watershed are presented to document conditions before implementation of Soil Conservation Service programs. Analyses of samples collected at three sites showed that water in Town Branch and East Prong Branch was of good quality except for bacteria, total residue, and sulfate concentrations, which at times exceeded criteria established by the Arkansas Department of Pollution Control and Ecology. (Woodard-USGS)
W79-04802

WATER-LEVEL DECLINES IN THE MADISON AREA, DANE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
R. S. McLeod.
Geological Survey open-file report 78-936, November 1978. 15 p, 9 fig, 2 tab, 5 ref.

Descriptors: *Groundwater, *Pumping, *Drawdown, *Water levels, *Computer models, Aquifer characteristics, Streamflow, Average flow, Hydrologic data, Water demand, Water supply, Maps, Projections, Wisconsin, *Madison area, *Surface water declines.

The water supply for the city of Madison, Wisconsin, and for surrounding municipalities is obtained from the ground-water reservoir that underlies the area. This ground-water reservoir is composed of an upper aquifer and an underlying sandstone aquifer. High-capacity water-supply wells pump from the sandstone aquifer. Pumping from the sandstone aquifer has resulted in hydrologic changes. The water level has dropped in both the upper aquifer and underlying sandstone aquifer, and the flow of water in streams has been reduced. The effects of anticipated pumping were examined with the use of a digital model. The maximum water-level decline from the beginning of pumping in 1882 until 1975 was about 75 feet in the sandstone aquifer and 10 to 20 feet in the upper aquifer. Additional declines between 1975 and 2000 were computed to be 10 to 30 feet in the sandstone aquifer and 5 to 10 feet in the upper aquifer. The average annual streamflow of the Yahara River at the McFarland gaging station was reduced 32 percent from the beginning of pumping to 1975. An additional 7 percent reduction in streamflow was computed for the period 1975 to 2000. (Woodard-USGS)
W79-04809

8. ENGINEERING WORKS

8A. Structures

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER CONVEYANCE SYSTEMS: 1973-1977.
Dames and Moore, Denver, CO.
For primary bibliographic entry see Field 6B.
W79-04761

TRENCHLESS DRAINAGE,
Advanced Drainage Systems, Inc., Columbus, OH.
R. C. Reeve.
Paper No. 78-2042, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 9 p. 9 fig. ASAE, St. Joseph, Michigan.

Descriptors: *Subsurface drainage, Subsurface drains, Drainage practices, Trenches, Costs, Groundwater.

Following the development of corrugated plastic tubing and automatic laser grade control in the 1960s, a dramatic move the 'trenchless' drainage has taken place in the 1970s. Low maintenance costs and high installation rates (up to 50,000 ft. per day) has given the competitive edge that is shifting the industry from trench to 'trenchless' drainage. (Skogerboe-Colorado State)
W79-04912

8B. Hydraulics

SLUICE GATES WITH HIGH DISCHARGE COEFFICIENTS,
Concordia Univ., Montreal (Quebec). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8C.
W79-04572

UNIFORMLY DISCHARGING LATERAL WEIRS,
Concordia Univ., Montreal (Quebec). Dept. of Civil Engineering.
A. S. Ramamurthy, K. Subramanya, and L. Carballada.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR4, Proceedings Paper 14252, p 399-412, December 1978. 8 fig, 2 tab, 11 ref, 3 append.

Descriptors: *Irrigation systems, *Discharge(Water), *Weirs, Laboratory tests, Flumes, Irrigation, Open channels, Open channel flow, Uniform flow, Model studies, Mathematical models, Hydraulics, Hydrodynamics, *Lateral weirs.

In certain applications, such as automated irrigation systems, multiple lateral weirs are housed in open channels in which spatially decreasing flow occurs. When the channel bed slope and the friction slope are very small, spatially decreasing subcritical channel flow results in a rising profile in the reach containing the multiple lateral weirs. This causes nonuniform distributions of weir outflows. For purposes of analysis, a single equivalent weir was considered, and it was shown that uniform water surface profile ensuring uniform outflow can be obtained by modifying the weir system geometry. The proposed methods are simple and easy to construct, even in existing channels. A number of tests were conducted to verify the proposed methods. The present study was limited to rectangular open channels. (Sims-ISWS)
W79-04573

HARD-ROCK WELLS GET MARIPOSA THROUGH THE DROUGHT,
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3B.
W79-04579

PROCEDURE FOR INTERPOLATING THE EPTH DISTRIBUTION OF SOIL MOISTURE ENSION (IN GERMAN),
idgenoessische Technische Hochschule, Zurich witzerland).
. Fluehler, and F. Richard.
Pflanzenernaehr Bodenkd, Vol. 140, No. 5, p 71-578. 1977. (English summary).

escriptors: *Hydraulic gradient, *Soil moisture, oisture tension, Depth.

programmable procedure is described to com-te hydraulic gradients from soil moisture ten-ons non-linearly distributed with depth. This in-rpolation-technique is based upon a geometrical ocedure. Compared with other curve smoothing chniques it is flexible with respect to the given ta constellation and requires a relatively small mputational effort. This method is compared ith that of cubic splines. - Copyright (c) 1978, ological Abstracts, Inc.
79-04723

REGULAR WAVE RUNUP AND OVERTOP-NG,
astal Engineering Research Center, Fort Bel-ir, VA.
r primary bibliographic entry see Field 2H.
79-04814

C. Hydraulic Machinery

LUICE GATES WITH HIGH DISCHARGE CO-FFICIENTS,
ncordia Univ., Montreal (Quebec). Dept. of vil Engineering.
S. Ramamurthy, K. Subramanya, and B. S. ni.
urnal of the Irrigation and Drainage Division, nerican Society of Civil Engineers, Vol. 104, . IR4, Technical Note, p 437-441, December 78. 4 fig, 7 ref, 1 append.

escriptors: *Sluice gates, *Discharge coefficients, aboratory tests, *Model studies, scharge(Water), Measurement, Theoretical anal-s, Analytical techniques, Hydralic models, Hy-ulics.

is study was undertaken to obtain higher values discharge coefficient, Cd, for a sluice gate by oiding the downstream contraction caused by conventional gate lips. A cylindrical lip of meter, d, was attached to the bottom of the gate let the flow cling to the gate exit section. nsequently, a low pressure was created in the oat section which in turn yielded a higher value Cd. Only the characteristics of flow past the e under submerged conditions were studied. r submerged flows, Cd was highly dependent on Reynolds number. The theoretical limit for Cd reed closely with the experimental data when ratio of d to gate opening, a, is large. For very v vaues of d/a and the ratio of gate opening to stream head, the lip acted like a perturbation and was of the order of 0.61. (Humphreys-ISWS)
79-04572

ANAGING THE LOW-YIELD WATER WELL,
drodyne Development Co., Forestville, CA.
r primary bibliographic entry see Field 4B.
79-04580

D. Soil Mechanics

NERALIZED STABILITY ANALYSIS OF ANNEL BANKS,
lorado State Univ., Fort Collins. Dept. of Civil gineering.
M. Ponce.
rnal of the Irrigation and Drainage Division, erican Society of Civil Engineers, Vol 104, No , Proceedings Paper 14228, p 343-350, Decem-1978. 3 fig, 2 tab, 6 ref, 2 append. EPA 05131010, R805457010.

Descriptors: *Stream stabilization, *Bank stability, *Slopes, *Model studies, Mathematical models, Theoretical analysis, Soil stability, Slope stability, Cohesive soils, Cohesion, Soil mechanics, Friction, Fluid friction, Banks, Channels, Soil science.

A generalized stability analysis of homogeneous bank slopes was presented. Cohesion, angle of friction, soil density, slope angle, and height were taken into account. The factor of safety against failure, as calculated for a suitable failure circle by the Simplified Bishop method, was expressed in terms of a stability number. Generalized charts relating the factor of safety to the slope height were developed. (Sims-ISWS)
W79-04574

8E. Rock Mechanics and Geology

HARD-ROCK WELLS GET MARIPOSA THROUGH THE DROUGHT,
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3B.
W79-04579

8G. Materials

FAILURE CRITERIA FOR CORRUGATED-PLASTIC DRAIN TUBING,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
P. N. Walker, C. L. Armstrong, and P. N. Singh.
Paper No. 78-2439, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 13 p. 8 fig, 2 tab, 5 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Plastic pipes, *Subsurface drains, Failure(Mechanics), Subsurface drainage, Pipes, Deflection.

Results from hydraulic-capacity, pipe-stiffness, and live-load carrying-capacity tests of permanently deflected drain tubing are presented. These tests are part of a continuing effort to define failure criteria for plastic drain tubing. (Skogerboe-Colorado State)
W79-04979

PREDICTION OF DEFLECTION FOR CORRUGATED PLASTIC TUBING,
Ohio Agricultural Research and Development Center, Columbus. Dept. of Agricultural Engineering.
A. D. Fenemor, B. R. Bevier, and G. O. Schwab.
Paper No. 78-2542, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 13 p, 4 fig, 3 tab, 13 ref. ASAE, St. Joseph, Michigan.

Descriptors: Subsurface drains, *Plastic pipes, Failure(Mechanics), Deflection, Pipes, *Subsurface drainage.

Measured deflections of tubing buried five years ago in a silty clay showed that the soil provides practically no side support against deflection. With measured deflection lag factors, the Iowa formula was the best of four methods for predicting deflection. Recommended maximum depths of burial are tabulated for tubing up to 381 mm diameter. (Skogerboe-Colorado State)
W79-04983

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

BIBLIOGRAPHY OF THE LITERATURE ON DROPWISE CONDENSATION, 1930-64,
Franklin Inst., Philadelphia, PA.
For primary bibliographic entry see Field 3A.
W79-04669

BIBLIOGRAPHY OF MEMBRANE TECHNOLOGY PERTAINING TO SALINE WATER DESALINATION: PART II.
Office of Water Research and Technology, Washington, DC. Biosciences Div.
For primary bibliographic entry see Field 3A.
W79-04945

10D. Specialized Information Center Services

CORROSION TEST PROGRAM,
Rice (Cyrus Wm.) and Co., Pittsburgh, PA.
For primary bibliographic entry see Field 3A.
W79-04677

SUBJECT INDEX

ABSORPTION
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. I. Accumulation from Seawater and a Food Source,
W79-04968 5A

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. II. Preliminary Investigation of Cadmium-Binding Proteins,
W79-04969 5A

Cadmium Turnover in the Shore Crab Carcinus Maenas,
W79-04973 5B

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

ABUNDANCE
Relative Abundance of Sympatric Species and Model of Exponentially Broken Rod (EBR),
W79-04541 5C

ACCESS ROUTES
Coastal Zone Plan Implementation,
W79-04709 6A

ACID MINE WATER
Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

ACTIVATED CARBON
Removal of Ammonia Nitrogen from Wastewater by Partial Chlorination Followed by Activated Carbon Treatment,
W79-04556 5D

Reduction of Aqueous HOCl with Activated Carbon,
W79-04615 5F

ACTIVATION ENERGY
Behavior of Water in Various States,
W79-04951 1A

ADENOSINE TRIPHOSPHATE
A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

ADJUDICATION PROCEDURES
Federal Water Pollution Control Act: The Sections 316 (A) and 316 (B) Process,
W79-04507 6E

ADMINISTRATION
Institutional Arrangements for Effective Water Management in Colorado,
W79-04503 6E

ADSORPTION
Predictive Model for Design of Fixed-Bed Adsorbers: Parameter Estimation and Model Development,
W79-04704 5D

AERATION
Laboratory Studies of Gas Tracers for Reaeration,
W79-04712 5A

AFRICA
Social and Economic Aspects of Water Exploitation,
W79-04760 6B

AGOSIA
Acute Toxicity of Copper, Zinc and Manganese in Single and Mixed Salt Solutions to Juvenile Longfin Dace, Agosia Chrysogaster,
W79-04833 5C

AGRICULTURAL RUNOFF
Nitrate and Phosphorus Runoff Losses from Small Watersheds in Great Lakes Basin,
W79-04535 5C

Input for a Stochastic Control Model of P Loading,
W79-04623 5B

AGRICULTURE
Quality Aspects of Agricultural Runoff and Drainage.
W79-04710 5B

A Socio-Economic Feasibility Study of the Proposed Rochester Dam,
W79-04869 6B

AIR POLLUTION
Oil Shale and the Environment,
W79-04522 6B

Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

AIR POLLUTION CONTROL
Advanced Steps Towards the Pollution-Free Bleached Sulfite Mill,
W79-04639 3C

ALASKA
Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

ALGAE
Notes on Freshwater Red Algae from West Malaysia,
W79-04768 5C

The Spring Phytoplankton Bloom in Lindaspollene, A Landlocked Norwegian Fjord. II. Biomass and Activity of Net-and Nanoplankton,
W79-04784 5C

Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

ALGORITHMS
Is the Soil Frozen or Not. An Algorithm Using Weather Records,
W79-04740 2G

ALIPHATIC COMPOUNDS
Determination of Petroleum Hydrocarbons in Water, Fish and Sediments Following the Ekofisk Blow-Out,
W79-04976 5A

ALKYL MERCURY
Contents of Total Mercury, Alkyl Mercury, and Methyl Mercury in Some Coastal Fish and Shells,
W79-04589 5A

ALUM
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

ALUMINUM
Biological Control of Dissolved Aluminum in Seawater: Experimental Evidence,
W79-04824 5D

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

ALUMINUM SULFATE
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

Mechanism of Aluminum Sulfate Recovery from Lignin Sludge (Mekhanism izvlecheniya sulfat alyuminiya iz shlam-lignina),
W79-04643 5D

AMMONIA
Ammonia Toxicity and pH Control in Fish Toxicity Bioassays of Treated Wastewaters,
W79-04817 5C

Chronic Exposure of Channel Catfish, Ictalurus Punctatus, to Ammonia: Effects on Growth and Survival,
W79-04835 5C

Ammonia Production Rates of Artemia Salina Under Various Culture Conditions,
W79-04971 5B

AMMONIA NITROGEN
Removal of Ammonia Nitrogen from Wastewater by Partial Chlorination Followed by Activated Carbon Treatment,
W79-04556 5D

AMMONIUM SALTS
The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

The Hydrolysis of Ammonium Ions in Sea Water-Experimental Confirmation of Predicted Constants at One Atmosphere Pressure,
W79-04844 5A

AMPHIURA FILIFORMIS
The Biology, Ecology, and Behavior of the Bivalve Mysella Bidentata (Montagu),
W79-04764 5C

ANADARA
Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

ANAEROBIC DIGESTION
Anaerobic Digestion and Membrane Separation of Domestic Wastewater,
W79-04597 5D

ANALYTICAL TECHNIQUES
Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

ANALYTICAL TECHNIQUES

Persistence Limits in Ecological Systems,
W79-04548 5C

The Development of Standard Laboratory and Field Ecosystem Research to Determine the Effects of Pollutants on the Marine Environment,
W79-04549 5C

Contents of Total Mercury, Alkyl Mercury, and Methyl Mercury in Some Coastal Fish and Shells,
W79-04589 5A

Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

A Computer Program for Simulating Salinity Loads in Streams,
W79-04800 5B

Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

ANEMIA

Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

ANIMAL BEHAVIOR

Increased Spontaneous Locomotor Activity in the Fiddler Crab, Uca Pugilator, After Exposure to a Sublethal Concentration of DDT,
W79-04629 5C

ANIMAL PATHOLOGY

Studies on Toxic Effects of Pesticides on Fish - II Toxic Effects of the Herbicide, Benthiocarb, on Carp. (In Japanese),
W79-04826 5C

ANIMAL PHYSIOLOGY

Behavior of Mercury in Bio-Systems II. Depuration of 203HG2+ in Various Trophic Levels,
W79-04619 5B

ANIMAL WASTES (WILDLIFE)

Ammonia Production Rates of Artemia Salina Under Various Culture Conditions,
W79-04971 5B

ANION EXCHANGE

The Osmionic Process,
W79-04948 3A

ANIONS

Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II,
W79-04517 3A

ANNELIDS

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

ANNUAL

Pennsylvania Annual Progress Report, 1978,
W79-04797 7C

ANNUAL SUMMARY REPORT

Pennsylvania Annual Progress Report, 1978,
W79-04797 7C

APALACHICOLA BAY (FL)

Verification of an Estuarine Model for Apalachicola Bay, Florida,
W79-04582 2L

AQUARIA

A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

AQUATIC ALGAE

Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

Trace Metals in the Common Mussel, Mytilus Edulis (L.), and in the Alga Fucus Vesiculosus (L.) from the Region of the Sound (Oresund),
W79-04840 5B

AQUATIC ANIMALS

Impact of Pesticides on the Marine Environment,
W79-04550 5C

AQUATIC BACTERIA

Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

AQUATIC ENVIRONMENT

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

AQUATIC LIFE

An Evaluation of the Effects of Geothermal Energy Development on Aquatic Biota in the Geysers Area of California,
W79-04962 6G

AQUATIC MICROORGANISMS

Biosolids as Food,
W79-04638 5C

Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

AQUATIC PLANTS

The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

Upgrading Faculative Wastewater Lagoons with Vascular Aquatic Plants,
W79-04830 5D

The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

Proceedings, Research Planning Conference on the Aquatic Plant Control Program, 3-7 October 1977.
W79-04932 4A

AQUATIC WEED CONTROL

Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

Proceedings, Research Planning Conference on the Aquatic Plant Control Program, 3-7 October 1977.
W79-04932 4A

AQUATIC WEEDS

Characterization of the Growth of Myriophyllum spicatum and Its Influence in the Aquatic Ecosystems of the Tennessee Valley,
W79-04625 4A

AQUICULTURE

Municipal Wastewater Aquaculture,
W79-04528 5D

Seasonal Growth and Succession of Tropical and Introduced Phytoplankton Cultured in Deep Sea Water,
W79-04772 5C

Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

The Hydrolysis of Ammonium Ions in Sea Water-Experimental Confirmation of Predicted Constants at One Atmosphere Pressure,
W79-04844 5A

Temperature Influences on Growth of Aquatic Organisms,
W79-04851 5C

AQUICULTURE TROUT

The Influence of Temperature and Wet Weight on the Oxygen Demand of Rainbow Trout (Salmo Gairdneri R.) in Fresh Water,
W79-04832 5C

AQUIFER CHARACTERISTICS

Geohydrology of the Northern Louisiana Salt Dome Basin Pertinent to the Storage of Radioactive Wastes--A Progress Report,
W79-04810 5E

AQUIFERS

Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

Delayed Aquifer Yield as a Phenomenon of Delayed Air Entry,
W79-04744 2G

On the Detection of Shallow Aquifers Using Thermal Infrared Imagery,
W79-04745 7B

On the Use of a Main Trend for the Kriging Technique in Hydrology,
W79-04870 2F

Mathematical Methods for Analysis of Fresh Water Lenses in the Coastal Zones of the Floridan Aquifer,
W79-04961 4B

ARCTIC

Sedimentation in a 'Half-Tide' Harbor, Part I. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

ARCTIC ESTUARIES
Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

ARCTIC OCEAN
Aspects of Water Column Primary Productivity in the Chukchi Sea During Summer,
W79-04765 5C

ARGOPECTEN
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

ARID LANDS
Subsurface Drainage Systems Installations in Arid Lands--The State of the Art,
W79-04907 5G

ARIZONA
Satellite Snow-Cover Observations in Arizona,
W79-04803 7B

ARKANSAS
Water-Quality Investigation of the Yellville Watershed, Arkansas,
W79-04802 7C

Trace Elements in the Sediments of the Buffalo River, Arkansas,
W79-04956 5A

ARKANSAS RIVER BASIN
Water Resources Data for Colorado, Water Year 1977--Volume 1. Missouri River Basin, Arkansas River Basin, Rio Grande Basin.
W79-04790 7C

ARNO RIVER (ITALY)
The Arno River Flood Study (1971-1976),
W79-04725 2E

ARSENIC COMPOUNDS
Factors Controlling the Estuarine Chemistry of Arsenic,
W79-04728 2L

ARTHROPODS
Annual Cycles of Some Cladocerans in a Polluted Stream,
W79-04820 5C

ARTIFICIAL LAKES
The Ecological History of a Mediaeval Man-Made Lake, Hickling Broad, Norfolk, United Kingdom,
W79-04777 5C

ARTIFICIAL RECHARGE
Mathematical Methods for Analysis of Fresh Water Lenses in the Coastal Zones of the Floridan Aquifer,
W79-04961 4B

ASCORBIC ACID
Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

ASSESSMENTS
Report of the Denver Workshop on State-Local-Federal Relationships in Socioeconomic Impact Assessment,
W79-04858 6B

ASSIMILATES
Studies on 14CO2-Assimilation in Marine Rhodophyceae,
W79-04766 5C

ATLANTIC OCEAN
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

Products of Photosynthesis in Natural Populations of Marine Phytoplankton from the Gulf of Maine,
W79-04763 5C

ATP
Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

AVAILABLE WATER
Hydrologic Appraisal of the Water Resources of the Homer-Preble Valley, New York,
W79-04796 6D

BACTERIA
The Development of Standard Methods of Measuring Microbiological Production,
W79-04545 5C

Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

Occurrence of Endophytic Bacteria in Siphonous Algae,
W79-04783 5C

BACTERIOPHAGE
Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

BACTERIOPLANKTON
A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

BANK STABILITY
Generalized Stability Analysis of Channel Banks,
W79-04574 8D

BARENTS SEA
Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

BARK RIVER (WI)
Flood Hazard Study: Bark River, Village of Dousman and Vicinity, Waukesha County, Wisconsin.
W79-04863 2E

BASE FLOW
Predictive Analyses of Ground-Water Discharges in the Willow Creek Watershed, Northeast Nebraska,
W79-04805 6A

BASELINE STUDIES
Water-Quality Investigation of the Yellville Watershed, Arkansas,
W79-04802 7C

BAYOU TECHE (LA)
Special Flood Hazard Information: Franklin, Louisiana and Vicinity, Yokely Bayou and Bayou Teche.
W79-04864 2E

BEACHES
Coastal Zone Plan Implementation,
W79-04709 6A

BENEFICIAL USE
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

Municipal Wastewater Aquaculture,
W79-04528 5D

BENEFITS
Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

BENTHIC FAUNA
The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

BENTHIC FLORA
Nitrogen-Fixation in the Littoral Benthos of an Oligotrophic Lake,
W79-04776 5C

BENTHIOCARB
Studies on Toxic Effects of Pesticides on Fish - II Toxic Effects of the Herbicide, Benthiocarb, on Carp. (In Japanese),
W79-04826 5C

BENTHOS
Vertical Migration of Benthos in Simulated Dredged Material Overburdens; Vol. I: Marine Benthos,
W79-04931 5E

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE
Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

BIBLIOGRAPHIES
Bibliography of the Literature on Dropwise Condensation, 1930-64,
W79-04669 3A

Bibliography of Membrane Technology Pertaining to Saline Water Desalination: Part II.
W79-04945 3A

BIG COW CREEK (TX)
A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

BIG THOMPSON RIVER (CO)
Flood Plain Information: Big Thompson River, Weld County, Colorado,
W79-04854 2E

BIOACCUMULATION
The Effect of Radioactive Pollution of Reservoirs on Fish,
W79-04543 5C

The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

Behavior of Mercury in Bio-Systems II. Depuration of 203HG2+ in Various Trophic Levels,
W79-04619 5B

The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

BIOACCUMULATION

Lead Accumulation in Plankton Blooms from Ullswater, The English Lake District,
W79-04819 5C

Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

Ambient Concentrations of PCBs in the Southeast from Storet Data and Selected EPA Studies,
W79-04848 5A

Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

The Potential Impacts on Aquatic Ecosystems from the Release of Trace Elements in Geothermal Fluids,
W79-04881 5B

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. I. Accumulation from Seawater and a Food Source,
W79-04968 5A

Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

BIOASSAY

Use of Biological Indicators for Monitoring Effect of Pollutants on the Marine Environment,
W79-04546 5C

Impact of Pesticides on the Marine Environment,
W79-04550 5C

Kinetic Analysis of Interactive Effects of Cadmium and Nitrate on Growth of Thalassiosira Fluviatilis (Bacillariophyceae),
W79-04587 5A

A Computer Monitored Aquatic Bioassay System,
W79-04652 5A

Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

An Automated Device (AGARS) for Studying Avoidance of Pollutant Gradients by Aquatic Organisms,
W79-04696 5A

Continuous Standard Water Delivery System for Bioassays with Aquatic Organisms,
W79-04770 5C

Ammonia Toxicity and pH Control in Fish Toxicity Bioassays of Treated Wastewaters,
W79-04817 5C

The Influence of Temperature and Wet Weight on the Oxygen Demand of Rainbow Trout (Salmo Gairdneri R.) in Fresh Water,
W79-04832 5C

Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

BIOCHEMICAL OXYGEN DEMAND

The Impact of Turpentine Recovery on the Toxicity and BOD of Kraft Mill Effluents,
W79-04534 5C

BIOCHEMISTRY

Studies on 14CO2-Assimilation in Marine Rhodophyceae,
W79-04766 5C

BIOCIDES

Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

BIOCONCENTRATION

Lead Accumulation in Plankton Blooms from Ullswater, The English Lake District,
W79-04819 5C

Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

BIOFOULING

Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

BIOINDICATORS

Use of Biological Indicators for Monitoring Effect of Pollutants on the Marine Environment,
W79-04546 5C

Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

Oil and Marine Organisms,
W79-04551 5C

BIOLOGICAL COMMUNITIES

Relative Abundance of Sympatric Species and Model of Exponentially Broken Rod (EBR),
W79-04541 5C

BIOLOGICAL MEMBRANES

Effect of Copper on Volume Regulation in the Marine Flagellate Dunaliella Marina,
W79-04972 5C

BIOLOGICAL TREATMENT

Pilot-Plant Study of Two-Stage Chemical-Biological Purification of Pulping Effluents at the Ostroleka Pulp and Paper Mill (Badania poltechniczne nad oczyszczaniem sciekow celulozowych z Ostroleckich Zakladow Celulozowo-Papierniczych w Ukladzie Dwustopniowym Chemiczno-Biologicznym),
W79-04631 5D

BIOLOGY

Biological Surveillance of Rivers: A Biological Monitoring Handbook,
W79-04634 7B

BIOLUMINESCENCE

Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

BIOMAGNIFICATION

Ambient Concentrations of PCBs in the Southeast from Storet Data and Selected EPA Studies,
W79-04848 5A

BIOMASS

A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

The Relationship Between Aboveground and Belowground Biomass of Freshwater Tidal Wetland Macrophytes,
W79-04627 2I

Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

The Spring Phytoplankton Bloom in Lindaspollene, A Landlocked Norwegian Fjord. II. Biomass and Activity of Net-and Nanoplankton,
W79-04784 5C

The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

BIOTA

Habitat Development Field Investigations, Bolivar Peninsula Marsh and Upland Habitat Development Site, Galveston Bay, Texas; Appendix D: Propagation of Vascular Plants and Post-Propagation Monitoring of Botanical, Soil, Aquatic Biota, and Wildlife Resources,
W79-04927 5E

BIRD EGGS

No. 2 Fuel Oil Decreases Embryonic Survival of Great Black-Backed Gulls,
W79-04628 5C

BIRDS

Flare Up Over North Sea Birds,
W79-04900 5C

BIVALVES

The Biology, Ecology, and Behavior of the Bivalve Mysella Bidentata (Montagu),
W79-04764 5C

Life Cycles and Population Dynamics of Marine Benthic Bivalves from the Disko Bugt Area of West Greenland,
W79-04767 5C

Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

BLACKWATER RIVER (ENGLAND)

A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

BLAST FURNACES

Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

BLEACHING WASTES

Electrochemical Coagulation of Industrial Effluents (Elektrokhimicheskaya koagulyatsiya promyshlennykh stokov),
W79-04630 5D

Application of Reverse Osmosis and Ultrafiltration to Purification of Pulp and Paper Industry Effluents. VI. Purification of Pulp Bleaching Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego),
W79-04632 5D

BOATING

Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

BORDEN COUNTY (TX)

Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water

in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

BORON
Sources, Levels, and Reactions of Boron in Florida Waters,
W79-04603 2K

BOTTOM SEDIMENT
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

BOTTOM SEDIMENTS
Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

BREAKWATERS
Irregular Wave Runup and Overtopping,
W79-04814 2H

BRINE SHRIMP
Ammonia Production Rates of Artemia Salina Under Various Culture Conditions,
W79-04971 5B

BRITISH COLUMBIA
Hydrologic Behavior of a Forested Mountain Soil in Coastal British Columbia,
W79-04564 2G

BROKEN ROD MODEL
Relative Abundance of Sympatric Species and Model of Exponentially Broken Rod (EBR),
W79-04541 5C

BRUSHLANDS
A Policy-Oriented Simulation Model of Debris Production from a Chaparral-Covered Watershed,
W79-04967 6A

BUFFALO RIVER (AR)
Trace Elements in the Sediments of the Buffalo River, Arkansas,
W79-04956 5A

BULK PRECIPITATION
Bulk Precipitation and Streamflow Quality Relationships in an Urban Area,
W79-04738 2E

BUOYANCY
Effect of Salt Upon Hot-Water Dispersion in Well-Mixed Estuaries,
W79-04729 2L

BURNING
Institutional Change and Fire Management,
W79-04966 6E

BYPRODUCTS
By-Products from Saline Water Conversion Plants: A Feasibility Study,
W79-04946 3A

CADMIUM
The Role of Plant Residues in the Fate of Cadmium in Ecosystems. A Buffer Against Contamination of Water Sources,
W79-04584 5B

Kinetic Analysis of Interactive Effects of Cadmium and Nitrate on Growth of Thalassiosira Fluviatilis (Bacillariophyceae),
W79-04587 5A

Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. I. Accumulation from Seawater and a Food Source,
W79-04968 5A

Cadmium Turnover in the Shore Crab Carcinus Maenas,
W79-04973 5B

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

CAESIUM
Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

CALCASIEU RIVER (LA)
Flood Plain Information: Calcasieu River, Oakdale, Louisiana,
W79-04861 2E

CALCIUM
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

CALCIUM SULFATE
Calcium-Supplying Characteristics of Two Gypsum Materials on Southeastern Coastal Plain Soils,
W79-04662 2G

Phosphate Removal Using Waste Calcium Sulfate,
W79-04977 5D

CALIBRATIONS
A Note on the Dynamic Calibration of Tipping-Bucket Gauges,
W79-04903 2B

CALIFORNIA
Hard-Rock Wells get Mariposa Through the Drought,
W79-04579 3B

Coastal Zone Plan Implementation,
W79-04709 6A

Optics of Turbid Estuarine Waters: Approximations and Applications,
W79-04734 1A

CANADA
Hydrologic Behavior of a Forested Mountain Soil in Coastal British Columbia,
W79-04564 2G

The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

CANADIAN SHIELD
The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

CAPILLARY ACTION
Rate of Capillary Water Ascent as Dependent on Physical Soil Properties, (In Czech),
W79-04751 2G

CAPILLARY CONDUCTIVITY
Behavior of Water in Various States,
W79-04951 1A

CAPITAL COSTS
Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

CARASSIUS
Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

CARBON
Transport of Nutrients and Carbon from the Nanaimo River to its Estuary,
W79-04726 2L

Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

CARBON DIOXIDE
Studies on 14CO2-Assimilation in Marine Rhodophyceae,
W79-04766 5C

Pathway and Products of CO2-Fixation by Green Prokaryotic Algae in the Cloacal Cavity of Diplosoma Virens,
W79-04787 5C

CARBON RADIOISOTOPES
Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

Products of Photosynthesis in Natural Populations of Marine Phytoplankton from the Gulf of Maine,
W79-04763 5C

CARP
Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

CATION EXCHANGE
The Osmionic Process,
W79-04948 3A

CATIONS
Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II.
W79-04517 3A

CAUSTIC WASH SOLUTIONS
Process for Treating Caustic Wash Solutions,
W79-04889 5D

CELLULOSE ACETATE
Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

Water and Ion Flow Through Imperfect Osmotic Membranes,
W79-04937 3A

Reverse Osmosis Membrane Regeneration,
W79-04954 3A

CENTRAL U.S.
Winter Storms and the Record-Breaking Winter in Illinois,
W79-04839 2B

CENTRIFUGATION
Research Continuation of Badger-Hickman Centrifugal Distillation Testing on Unit Number 4.
W79-04955 3A

CERIUM
Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

CHANNEL CATFISH
Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

Chronic Exposure of Channel Catfish, Ictalurus Punctatus, to Ammonia: Effects on Growth and Survival,
W79-04835 5C

CHANNEL FLOW
Temporal Moments for Longitudinal Dispersion,
W79-04732 5B

CHANNEL IMPROVEMENT
Walnut Creek Channel Improvement Project, Contra Costa County, California; Hydraulic Model Investigation,
W79-04923 2E

CHANNELIZATION
Channelization and Invertebrate in Some Iowa Streams,
W79-04789 2E

CHELATION
Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

CHEMICAL ANALYSIS
Volatile Liquid Hydrocarbons in the Surface Coastal Waters of the Gulf of Mexico,
W79-04560 5C

Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

Trace Elements in the Sediments of the Buffalo River, Arkansas,
W79-04956 5A

The Effect of Recreation on Water Quality,
W79-04963 5B

CHEMICAL LOADS
A Computer Program for Simulating Salinity Loads in Streams,
W79-04800 5B

CHEMICAL OXYGEN DEMAND
Dissolved Oxygen Demand of Reduced Chemical Species in the Water Column of Sebasticook Lake, Maine,
W79-04684 2H

CHEMICAL PRECIPITATION
Chemical Precipitation-Coagulation for Organic Color Removal from Groundwaters,
W79-04614 5F

CHEMICAL PROPERTIES
Selected Water-Quality Data from the Merced River, California, November 1976 Through August 1977,
W79-04794 5B

CHEMICAL REACTIONS
The Hydrolysis of Ammonium Ions in Sea Water-Experimental Confirmation of Predicted Constants at One Atmosphere Pressure,
W79-04844 5A

CHEMICAL RECOVERY
Mechanism of Aluminum Sulfate Recovery from Lignin Sludge (Mekhanism izvlecheniya sulfat alyuminiya iz shlam-lignina),
W79-04643 5D

CHEMICAL TREATMENT SYSTEM
Chemical Precipitation-Coagulation for Organic Color Removal from Groundwaters,
W79-04614 5F

CHEMICALS
The Interrelationships Among Chemical Parameters in Rivers--Analysing the Effect of Natural and Anthropogenic Sources,
W79-04569 5B

Energy for Production of Consumable Materials,
W79-04713 5D

CHEMILUMINESCENCE
Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

CHERNOZEMS
Changes in Biochemical Characteristics of Chernozem Soils in the Region of the Western Slope of the Ural Mountains During Irrigation,
W79-04706 2G

CHESAPEAKE BAY
Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

CHILE
Water Utilization and Reallocation in Chile: A Study of the Pirque Valley,
W79-04695 6A

New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

CHLORINATED HYDROCARBONS
Distribution of Stable Organic Molecules in the Marine Environment: Physical Chemical Aspects. Chlorinated Hydrocarbons,
W79-04559 5C

CHLORINATION
Removal of Ammonia Nitrogen from Wastewater by Partial Chlorination Followed by Activated Carbon Treatment,
W79-04556 5D

Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

CHLORINE
Reduction of Aqueous HOCl with Activated Carbon,
W79-04615 5F

Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

An Automated Device (AGARS) for Studying Avoidance of Pollutant Gradients by Aquatic Organisms,
W79-04696 5A

Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

Added Chlorine in Aquatic Environments,
W79-04899 5C

CHLOROPHYLL
Aspects of Water Column Primary Productivity in the Chukchi Sea During Summer,
W79-04765 5C

CHLOROPHYTA
New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

Pathway and Products of CO2-Fixation by Green Prokaryotic Algae in the Cloacal Cavity of Diplosoma Virens,
W79-04787 5C

Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

CHROMIUM
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

CHUKCHI SEA
Aspects of Water Column Primary Productivity in the Chukchi Sea During Summer,
W79-04765 5C

CLAMS
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

CLASSIFICATION
Notes on Freshwater Red Algae from West Malaysia,
W79-04768 5C

New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

CLAYS
Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary,
W79-04730 2L

CLEANING
Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

Reverse Osmosis Membrane Regeneration,
W79-04954 3A

COAGULATION
Removal of Color from Carbonate Pulping Effluent -- The Calcium-Magnesium Coagulation Process,
W79-04635 5D

COAGULATION FACTORS
Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

COAL
Coal Humic Substances for the Treatment of Wastewater from Stack Gas Scrubbers, Coal Conversion Plants, and Other Coal Utilization Facilities,
W79-04554 5D

COAL-FIRED POWERPLANTS
A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

COAL MINE WASTES
Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development,
W79-04808 6A

COALS
Environmental Assessment of Coal Transportation,
W79-04531 5C

COASTAL ZONE MANAGEMENT
Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

COASTS
Stony Brook Harbor: An Interdisciplinary Analysis,
W79-04862 6B

Oil Spills: The Strategy of Recovery,
W79-04904 5C

COBALT
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

COLD CORE RINGS
Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

COLONIZATION
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

COLORADO
Institutional Arrangements for Effective Water Management in Colorado,
W79-04503 6E

Water Law - Rights of Importers and Developers of Water. City and County of Denver v. Fulton Irrigating Ditch Co., 506 P.2d 144 (Colo. 1972),
W79-04594 6E

Water Resources Data for Colorado, Water Year 1977--Volume 1. Missouri River Basin, Arkansas River Basin, Rio Grande Basin.
W79-04790 7C

Water Resources Data for Colorado, Water Year 1977--Volume 2. Colorado River Basin Above Dolores River.
W79-04791 7C

Water Resources Data for Colorado, Water Year 1977--Volume 3. Dolores River Basin, Green River Basin, San Juan River Basin.
W79-04792 7C

Flood Plain Information: Big Thompson River, Weld County, Colorado,
W79-04854 2E

Flood Plain Information: Salt Creek - Vicinity of Pueblo, Colorado.
W79-04865 2E

An Analysis of Drought Research Needs for Colorado Agriculture,
W79-04964 3B

COLORADO RIVER
Agriculture and Salinity,
W79-04659 5G

International Problems,
W79-04660 6E

COLORADO RIVER BASIN
Water Resources Data for Colorado, Water Year 1977--Volume 2. Colorado River Basin Above Dolores River.
W79-04791 7C

Water Policy and Decision-Making in the Colorado River Basin,
W79-04868 6E

COMBINED SEWERS
The Application of Optimal Linear Regulator Theory to a Problem in Water Pollution,
W79-04596 7B

COMMERCIAL FISHING
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

COMMERCIAL SHELLFISH
Paralytic Shellfish Toxins in the Sea Scallop, Placopecten Magellanicus, in the Bay of Fundy,
W79-04825 5A

Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

COMPARISON TECHNIQUES
Comparison of Alternative Engineering Designs,
W79-04690 6A

COMPUTER MODELS
Simulation of Urban Non-Point Source Pollution,
W79-04609 5B

Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

Predictive Analyses of Ground-Water Discharges in the Willow Creek Watershed, Northeast Nebraska,
W79-04805 6A

Water-Level Declines in the Madison Area, Dane County, Wisconsin,
W79-04809 7C

Computer Model of Two-Dimensional Solute Transport and Dispersion in Ground Water,
W79-04813 6A

A Policy-Oriented Simulation Model of Debris Production from a Chaparral-Covered Watershed,
W79-04967 6A

An Erosion Model for Arid Wildland Watersheds,
W79-04994 2J

COMPUTER PROGRAMS
A Computer Program for Simulating Salinity Loads in Streams,
W79-04800 5B

Computer Programming Solid Set Systems,
W79-04913 3F

CONDENSATES
Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

CONDENSATION
Development of Direct Contact Condensation Multistage Flash Distillation Process: Phase II,
W79-04521 3A

Bibliography of the Literature on Dropwise Condensation, 1930-64,
W79-04669 3A

CONJUCTIVE USE
Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

CONNECTICUT RIVER
The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

CONSERVATION AREAS
Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

CONSTRUCTION COSTS
Construction Costs for Municipal Wastewater Conveyance Systems: 1973-1977.
W79-04761 6B

CONSTRUCTION GRANTS PROGRAM
Construction Costs for Municipal Wastewater Conveyance Systems: 1973-1977.
W79-04761 6B

CONSTRUCTION MATERIALS
Corrosion Test Program,
W79-04677 3A

CONSUMER ACCEPTANCE
Quality Considerations for Water Supply Evaluations,
W79-04714 6B

CONTAINMENT AREAS
A Methodology for Determining Land Value and Associated Benefits Created from Dredged Material Containment,
W79-04933 5E

CONTAINMENT STRUCTURES
Design Concepts for In-Water Containment Structures for Marsh Habitat Development,
W79-04925 5E

CONTINENTAL SHELF
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

CONTOUR FURROWS
Contour Furrow Irrigation with Liquid Manure Using 'Microtubing' for Flow Control,
W79-04982 3F

CONTROL SYSTEMS
The Application of Optimal Linear Regulator Theory to a Problem in Water Pollution,
W79-04596 7B

CONVEYANCE STRUCTURES
Construction Costs for Municipal Wastewater Conveyance Systems: 1973-1977.
W79-04761 6B

COORDINATION
Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

COPEPODS
Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

COPOLYMERS
New Synthetic Membranes for Reverse Osmosis Desalination,
W79-04520 3A

COPPER
Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

Acute Toxicity of Copper, Zinc and Manganese in Single and Mixed Salt Solutions to Juvenile Longfin Dace, Agosia Chrysogaster,
W79-04833 5C

The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

Effect of Copper on Volume Regulation in the Marine Flagellate Dunaliella Marina,
W79-04972 5C

CORE DRILLING
Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

CORN
A Simplified Model of Corn Growth Under Moisture Stress,
W79-04607 2D

Physiological Reaction of Different Corn Hybrids to Drought (In Russian),
W79-04708 3F

Management for Minimizing Nitrogen Leaching Losses on Irrigated Sandy Soils,
W79-04980 3F

Estimating Evapotranspiration Rates for Corn in Delaware,
W79-04988 2D

CORN (FIELD)
Dry Matter Production and Translocation in Maize Subjected to Drought During Grain Fill,
W79-04606 2I

CORPS OF ENGINEERS
Improvements Needed in the Corps of Engineers' Regulatory Program for Protecting the Nation's Waters.
W79-04871 6B

CORROSION
Corrosion Test Program,
W79-04677 3A

COST-BENEFIT ANALYSIS
The Development of a Combined Water Quality Index,
W79-04610 6B

Economic Performance of Reservoirs a Sensitivity Analysis,
W79-04711 6B

Economic Issues Related to Large-Scale Water Transfers in the USA,
W79-04759 6D

A Socio-Economic Feasibility Study of the Proposed Rochester Dam,
W79-04869 6B

Financing Regional Drainage Facilities Under 1978 Economic Conditions,
W79-04911 5G

COST-BENEFIT RATIO
Benefits and Costs of Water Quality Improvements,
W79-04699 6B

COST-BENEFITS ANALYSIS
Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

COSTS
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

A Model for Determining the Impact of Control Costs on Municipal Finances,
W79-04698 6C

Quality Considerations for Water Supply Evaluations,
W79-04714 6B

Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

COVINGTON (LA)
Flood Plain Information: Tchefuncta River and Tributaries, Covington, LA.
W79-04855 2E

CRABS
Increased Spontaneous Locomotor Activity in the Fiddler Crab, Uca Pugilator, After Exposure to a Sublethal Concentration of DDT.
W79-04629 5C

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. I. Accumulation from Seawater and a Food Source.
W79-04968 5A

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. II. Preliminary Investigation of Cadmium-Binding Proteins.
W79-04969 5A

Cadmium Turnover in the Shore Crab Carcinu Maenas,
W79-04973 5

Uptake from Water and Tissue Distribution o Neptunium-237 in Crabs, Shrimp and Mussel
W79-04975 5A

CROP PRODUCTION
Nitrate and Phosphorus Runoff Losses fro Small Watersheds in Great Lakes Basin,
W79-04535 5

Quality Considerations for Water Supply Evalu ations,
W79-04714 6

CROP RESPONSE
Water Absorption by Plants in a Dry Wind an Under Periodic Spraying with Water (In Rus sian),
W79-04707 3

Physiological Reaction of Different Corn Hy brids to Drought (In Russian),
W79-04708 3

CRUDE OIL
Determination of Petroleum Hydrocarbons i Water, Fish and Sediments Following the Eko fisk Blow-Out,
W79-04976 5A

CRUSTACEANS
Cyclomorphosis in Daphnia Carinata Kin (Crustacea: Cladocera) from Two Adjacen Sewage Lagoons in South Australia,
W79-04821 5

CRYSTAL GROWTH
Nucleation and Growth of Ice Crystals,
W79-04673 3A

CYANOPHYTA
Nitrogen-Fixation in the Littoral Benthos of a Oligotrophic Lake,
W79-04776 5

CYCLOMORPHOSIS
Cyclomorphosis in Daphnia Carinata Kin (Crustacea: Cladocera) from Two Adjacen Sewage Lagoons in South Australia,
W79-04821 5

CYPERUS
The Growth and Biomass Distribution of Tw Emergent Freshwater Plants, Cyperus Esculen tus and Scirpus Validus, on Different Sediments
W79-04838 5

CYTOLOGICAL STUDIES
UV-Induced Developmental Abnormalities i the Filamentous Blue-Green Alga Nosto Linckia,
W79-04779 5

Synchronized Culture of the Halotolerant Uni cellular Green Alga Dunaliella parva,
W79-04780 5

D. VIRIDIS
Synchronized Culture of the Halotolerant Uni cellular Green Alga Dunaliella parva,
W79-04780 5

DADE COUNTY
Summary of Hydrologic Data Collected Durin 1976 in Dade County, Florida,
W79-04795 7

DAMS
A Socio-Economic Feasibility Study of the Pro posed Rochester Dam,
W79-04869 6

DAPHNIA
Annual Cycles of Some Cladocerans in a Polluted Stream,
W79-04820 5C

Cyclomorphosis in Daphnia Carinata King (Crustacea: Cladocera) from Two Adjacent Sewage Lagoons in South Australia,
W79-04821 5C

DATA COLLECTIONS
Occurrence, Quantity, and Quality of Ground Water in Taylor County, Texas.
W79-04575 2F

Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

Solar Energy Information and Data for Illinois,
W79-04719 2B

DAWSON COUNTY (TX)
Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

DBS
The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

DDT
Increased Spontaneous Locomotor Activity in the Fiddler Crab, Uca Pugilator, After Exposure to a Sublethal Concentration of DDT,
W79-04629 5C

DECISION MAKING
Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

Summary Report of Phase II. Development of Techniques for Estimating the Potentials of Water Resources Development in Achieving National and Regional Social Goals.
W79-04965 6B

DECOLORING
Removal of Color from Carbonate Pulping Effluent -- The Calcium-Magnesium Coagulation Process,
W79-04635 5D

DEEP WATER
Seasonal Growth and Succession of Tropical and Introduced Phytoplankton Cultured in Deep Sea Water,
W79-04772 5C

DEGRADATION
Hydrolytic and Photochemical Degradation of Organophosphorus Pesticides,
W79-04682 5B

DEHYDROASCORBIC ACID
Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

DELAWARE RIVER BASIN COMMISSION
Institutional Concerns: The Delaware Experience,
W79-04804 4A

DELPHI METHOD
An Analytical Model for Establishing Water Resources Development Priorities,
W79-04586 6B

DEMAND
Economic Issues Related to Large-Scale Water Transfers in the USA,
W79-04759 6D

DEMINERALIZATION
Mechanism of Electrode Demineralization,
W79-04672 3A

Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

DEMONSTRATION PLANT NO. 1
Fourth Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-04953 3A

DEMONSTRATION PLANT NO. 2
Saline Water Conversion Demonstration Plant, Point Loma I, San Diego, California: Second Annual Report.
W79-04943 3A

DENVER (COLO)
Water Law - Rights of Importers and Developers of Water. City and County of Denver v. Fulton Irrigating Ditch Co., 506 P.2d 144 (Colo. 1972),
W79-04594 6E

DEPTH-DAMAGE CURVES
A Proposed Method of Evaluating Flood Damages to Historic Homes--An Externality Approach,
W79-04702 6B

DEPURATION
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

DESALATION
Fifth Annual Report, Saline Water Conversion Plant No. 1, Freeport, Texas.
W79-04519 3A

DESALINATION
Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

Reverse Osmosis Membranes Containing Graphitic Oxide,
W79-04665 3A

The Mechanism of Mass Transfer Through a Liquid Interface,
W79-04666 3A

Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

Bibliography of the Literature on Dropwise Condensation, 1930-64,
W79-04669 3A

Heat Transfer in the Liquid-Liquid Spray Tower,
W79-04670 3A

The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-04671 3A

Mechanism of Electrode Demineralization,
W79-04672 3A

Nucleation and Growth of Ice Crystals,
W79-04673 3A

Washing of Brine from Ice Crystals,
W79-04674 3A

A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

Use of Waste Heat for Production of Fresh Water,
W79-04676 3A

Corrosion Test Program,
W79-04677 3A

Second Report on Fabrication and Evaluation of New Ultrathin Reverse Osmosis Membranes,
W79-04678 3A

Water Purification by Reverse Osmosis,
W79-04887 3A

Reverse Osmosis Desalination Apparatus and Method,
W79-04898 3A

Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

The Zone-Purification Process as a Method of Preparation of Potable Water from Sea Water,
W79-04936 3A

Economic Evaluation Study of Distillation of Saline Water by Means of Forced-Circulation Vapor-Compression Distillation Equipment,
W79-04939 3A

Energy and Mass Transfer in Partial-Pressure Distillation,
W79-04940 3A

Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

Donnan Softening as a Pretreatment to Desalination Processes,
W79-04949 3A

Fourth Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-04953 3A

Research Continuation of Badger-Hickman Centrifugal Distillation Testing on Unit Number 4.
W79-04955 3A

DESALINATION APPARATUS
Development of a Thin-Liquid-Film Membrane Unit for Desalination by Reverse Osmosis,
W79-04515 3A

Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

The Mechanism of Mass Transfer Through a Liquid Interface,
W79-04666 3A

Heat Transfer in the Liquid-Liquid Spray Tower,
W79-04670 3A

Permeability Requirements of Membranes for Use in Desalination by Reverse Osmosis,
W79-04679 3A

DESALINATION APPARATUS

Reverse Osmosis Desalination Apparatus and Method,
W79-04898 3A

Water and Ion Flow Through Imperfect Osmotic Membranes,
W79-04937 3A

Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

The Osmionic Process,
W79-04948 3A

DESALINATION PLANTS

Conceptual Design Study of a One Million Gallon Per Day MSM Desalination Plant Replacement for Demonstration Plant No. 2 at Point Loma, San Diego, California.
W79-04511 3A

Fifth Annual Report, Saline Water Conversion Plant No. 1, Freeport, Texas.
W79-04519 3A

Use of Waste Heat for Production of Fresh Water,
W79-04676 3A

Corrosion Test Program,
W79-04677 3A

Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

Saline Water Conversion Demonstration Plant, Point Loma I, San Diego, California: Second Annual Report.
W79-04943 3A

By-Products from Saline Water Conversion Plants: A Feasibility Study,
W79-04946 3A

Fourth Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-04953 3A

DESALINATION PROCESSES

Conceptual Design Study of a One Million Gallon Per Day MSM Desalination Plant Replacement for Demonstration Plant No. 2 at Point Loma, San Diego, California.
W79-04511 3A

Final Three Years' Progress on Study and Field Evaluation of Sea Water Stills.
W79-04512 3A

Research on Methods for Solar Distillation,
W79-04513 3A

Development of a Thin-Liquid-Film Membrane Unit for Desalination by Reverse Osmosis,
W79-04515 3A

Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II,
W79-04517 3A

Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

Fifth Annual Report, Saline Water Conversion Plant No. 1, Freeport, Texas.
W79-04519 3A

Reverse Osmosis Membranes Containing Graphitic Oxide,
W79-04665 3A

The Mechanism of Mass Transfer Through a Liquid Interface,
W79-04666 3A

The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-04671 3A

Mechanism of Electrode Demineralization,
W79-04672 3A

Nucleation and Growth of Ice Crystals,
W79-04673 3A

Washing of Brine from Ice Crystals,
W79-04674 3A

A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

The Zone-Purification Process as a Method of Preparation of Potable Water from Sea Water,
W79-04936 3A

Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

Donnan Softening as a Pretreatment to Desalination Processes,
W79-04949 3A

Fourth Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-04953 3A

DESCALING

Reverse Osmosis Membrane Regeneration,
W79-04954 3A

DETERGENTS

The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

DETERMINISTIC MODELS

Problems of Modeling the Effect of Pollution on Biological Systems of the Ocean,
W79-04539 5C

DETOXIFICATION

Toxicity Removal by Primary Treatment (of Kraft Pulp Mill Effluent),
W79-04637 5D

DEWATERING

Papermaking Primary Sludges. Dewatering Studies Realized with Different Industrial Devices (Boues primaires de papeterie. Essais de deshydratation realises avec differents appareils industriels),
W79-04581 5D

Filter Belts vs. Pressure in Dewatering of Sludges,
W79-04641 5D

Dewatering of High-Ash Sediments of Effluents (Obezvozhivamie vysokozolinykh osadkov stochnykh vod),
W79-04644 5D

DIALYSIS

A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

DIATOMS

Effects of Lead on Growth of the Marine Diatom Skeletonema Costatum,
W79-04600 5C

Seasonal Growth and Succession of Tropical and Introduced Phytoplankton Cultured in Deep Sea Water,
W79-04772 5C

Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

Biological Control of Dissolved Aluminum in Seawater: Experimental Evidence,
W79-04824 5D

DIFFUSION

Predictive Model for Design of Fixed-Bed Adsorbers: Parameter Estimation and Model Development,
W79-04704 5D

Temporal Moments for Longitudinal Dispersion,
W79-04732 5B

DILLINGHAM (AK)

Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

DIPLOSOMA VIRENS

Pathway and Products of CO2-Fixation by Green Prokaryotic Algae in the Cloacal Cavity of Diplosoma Virens,
W79-04787 5C

DISCHARGE COEFFICIENTS

Sluice Gates with High Discharge Coefficients,
W79-04572 8C

DISCHARGE (WATER)

Uniformly Discharging Lateral Weirs,
W79-04573 8B

DISKO BUGT (GREENLAND)

Life Cycles and Population Dynamics of Marine Benthic Bivalves from the Disko Bugt Area of West Greenland,
W79-04767 5C

DISPERSION

Effect of Salt Upon Hot-Water Dispersion in Well-Mixed Estuaries,
W79-04729 2L

Temporal Moments for Longitudinal Dispersion,
W79-04732 5B

DISSOLVED ORGANIC CARBON

Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

DISSOLVED OXYGEN

Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

DISTILLATION

Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

Economic Evaluation Study of Distillation of Saline Water by Means of Forced-Circulation Vapor-Compression Distillation Equipment,
W79-04939 3A

Energy and Mass Transfer in Partial-Pressure Distillation,
W79-04940 3A

DISTRIBUTION
Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

DISTRIBUTION PATTERNS
Three-Dimensional Temperature Model for Shallow Lakes,
W79-04731 5B

DIVERSION
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

Water Law - Rights of Importers and Developers of Water. City and County of Denver v. Fulton Irrigating Ditch Co., 506 P.2d 144 (Colo. 1972),
W79-04594 6E

DIVERSITY
The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

DIVERSITY INDICES
The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

DOLORES RIVER
Water Resources Data for Colorado, Water Year 1977--Volume 2. Colorado River Basin Above Dolores River.
W79-04791 7C

DOLORES RIVER BASIN
Water Resources Data for Colorado, Water Year 1977--Volume 3. Dolores River Basin, Green River Basin, San Juan River Basin.
W79-04792 7C

DOMESTIC WASTES
Anaerobic Digestion and Membrane Separation of Domestic Wastewater,
W79-04597 5D

Water-Conservation Methods to Meet Pennsylvania's Water Needs,
W79-04598 3D

Phytoplankton Ecology of Vancouver Harbor,
W79-04617 5B

DOMINANT ORGANISMS
Seasonal Growth and Succession of Tropical and Introduced Phytoplankton Cultured in Deep Sea Water,
W79-04772 5C

DOWSING
The Water Witch: Fact . . . or Fiction.
W79-04578 7B

DRAINAGE
Quality Aspects of Agricultural Runoff and Drainage.
W79-04710 5B

Drainage Requirements for Lowland Rice,
W79-04908 5G

Agricultural Drainage Problems in Kern County, California,
W79-04909 5G

Financing Regional Drainage Facilities Under 1978 Economic Conditions,
W79-04911 5G

DRAINAGE DENSITY
Drainage Density and Streamflow: A Closer Look,
W79-04736 2E

DRAINAGE EFFICIENCY
Drainage Density and Streamflow: A Closer Look,
W79-04736 2E

DRAINAGE SYSTEMS
Analysis of Combination Surface-Subsurface Drainage Systems for Humid Region Soils,
W79-04989 4B

Incorporating Crop Needs into Drainage System Design,
W79-04998 4B

DRAWDOWN
Water-Level Declines in the Madison Area, Dane County, Wisconsin,
W79-04809 7C

DREDGED MATERIAL
A Methodology for Determining Land Value and Associated Benefits Created from Dredged Material Containment,
W79-04933 5E

DREDGED MATERIAL DISPOSAL
An Analysis of the Functional Capabilities and Performance of Silt Curtains.
W79-04924 5E

Design Concepts for In-Water Containment Structures for Marsh Habitat Development,
W79-04925 5E

Case Studies and Comparative Analyses of Issues Associated with Productive Land Use at Dredged Material Disposal Sites,
W79-04926 5E

Habitat Development Field Investigations, Bolivar Peninsula Marsh and Upland Habitat Development Site, Galveston Bay, Texas; Appendix D: Propagation of Vascular Plants and Post-Propagation Monitoring of Botanical, Soil, Aquatic Biota, and Wildlife Resources,
W79-04927 5E

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

Needs and Areas of Potential Application of Disposal Area Reuse Management (DARM),
W79-04930 5E

Vertical Migration of Benthos in Simulated Dredged Material Overburdens; Vol. I: Marine Benthos,
W79-04931 5E

Development of Procedures for Selecting and Designing Reusable Dredged Material Disposal Sites,
W79-04934 5E

DREDGING
Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

DRILL HOLES
Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

DRILLING
The Water Witch: Fact . . . or Fiction.
W79-04578 7B

Hard-Rock Wells get Mariposa Through the Drought,
W79-04579 3B

DRIP IRRIGATION
Peach Tree Response to Drip Application of Water and Nutrients,
W79-04981 3F

Drip Irrigation of Orange Trees in Humid Climate,
W79-04991 3F

DROPWISE CONDENSATION
Bibliography of the Literature on Dropwise Condensation, 1930-64,
W79-04669 3A

Economic Evaluation Study of Distillation of Saline Water by Means of Forced-Circulation Vapor-Compression Distillation Equipment,
W79-04939 3A

DROUGHT
An Analysis of Drought Research Needs for Colorado Agriculture,
W79-04964 3B

DROUGHT RESISTANCE
Physiological Reaction of Different Corn Hybrids to Drought (In Russian),
W79-04708 3F

DROUGHTS
Hard-Rock Wells get Mariposa Through the Drought,
W79-04579 3B

DRUMS
Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

DUCKWEED
Upgrading Faculative Wastewater Lagoons with Vascular Aquatic Plants,
W79-04830 5D

DUNALIELLA
Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

Effect of Copper on Volume Regulation in the Marine Flagellate Dunaliella Marina,
W79-04972 5C

DUNALIELLA PARVA
Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

DURBAN (SOUTH AFRICA)
Nutrient Budget for a Residential Stormwater Catchment in Durban, South Africa,
W79-04565 5B

DYNAMIC CALIBRATION
A Note on the Dynamic Calibration of Tipping-Bucket Gauges,
W79-04903 2B

DYNAMICS
A Note on the Dynamic Calibration of Tipping-Bucket Gauges,
W79-04903 2B

ECOLOGY
Relative Abundance of Sympatric Species and Model of Exponentially Broken Rod (EBR),
W79-04541 5C

ECONOMIC EFFICIENCY
Water Utilization and Reallocation in Chile: A Study of the Pirque Valley,
W79-04695 6A

ECONOMIC EVALUATION
Research on Methods for Solar Distillation,
W79-04513 3A

Economic Evaluation Study of Distillation of Saline Water by Means of Forced-Circulation Vapor-Compression Distillation Equipment,
W79-04939 3A

ECONOMIC IMPACT
A Socio-Economic Feasibility Study of the Proposed Rochester Dam,
W79-04869 6B

ECONOMIC MODEL
The Development of a Combined Water Quality Index,
W79-04610 6B

ECONOMICS
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

Analyzing the Impact of Land Use on Sewer Service Area Planning,
W79-04701 6A

'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

Economic Issues Related to Large-Scale Water Transfers in the USA,
W79-04759 6D

Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

Economic Evaluation Study of Distillation of Saline Water by Means of Forced-Circulation Vapor-Compression Distillation Equipment,
W79-04939 3A

ECOSYSTEMS
Design of Simulation Models to Determine Biological Impact of Pollutants on the Marine Environment,
W79-04538 5C

Problems of Modeling the Effect of Pollution on Biological Systems of the Ocean,
W79-04539 5C

Persistence Limits in Ecological Systems,
W79-04548 5C

EDIBLE OIL POLLUTION
Edible-Oil Pollution on Fanning Island,
W79-04841 5B

EFFECTS
A Model for Determining the Impact of Control Costs on Municipal Finances,
W79-04698 6C

Analyzing the Impact of Land Use on Sewer Service Area Planning,
W79-04701 6A

EFFLUENTS
The Effects of Heated Effluents on the Production of Marine Plankton (Takahama Nuclear Power Station-I) (In Japanese),
W79-04842 5B

ELECTRIC POWERPLANTS
Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

ELECTROCHEMISTRY
Electrochemical Coagulation of Industrial Effluents (Elektrokhimicheskaya koagulyatsiya promyshlennykh stokov),
W79-04630 5D

ELECTRODIALYSIS
Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II,
W79-04517 3A

Investigation of Inorganic Ion Exchange Membranes for Electrodialysis Application,
W79-04942 3A

ELECTROLYSIS
Mechanism of Electrode Demineralization,
W79-04672 3A

ELECTROLYTES
Transport of Electrolytes Through Membrane Systems, Second Annual Report,
W79-04952 3A

ELEOCHARIS
The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

ELLIOTT BAY (WASH)
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

ENCHYTRAEUS
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

ENDOPHYTES
Occurrence of Endophytic Bacteria in Siphonous Algae,
W79-04783 5C

ENDRIN
Impact of Pesticides on the Marine Environment,
W79-04550 5C

ENERGY
Oil Shale and the Environment,
W79-04522 6B

Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

Energy for Production of Consumable Materials,
W79-04713 5D

ENERGY CONSUMPTION
Energy for Production of Consumable Materials,
W79-04713 5D

ENERGY CONVERSION
Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

ENERGY GRADIENTS
Walnut Creek Channel Improvement Project, Contra Costa County, California; Hydraulic Model Investigation,
W79-04923 2E

ENERGY IMPACTS
Report of the Denver Workshop on State-Local-Federal Relationships in Socioeconomic Impact Assessment,
W79-04858 6B

ENFORCEMENT
Methodology for Designing Cost-Effective Monitoring and Compliance Strategies for Pesticide Use,
W79-04524 6A

ENGINEERING
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

ENGLAND
Urban Runoff from a Road Surface--A Water Quality Study,
W79-04567 5B

Nitrates in Water Supply Abstractions in the Anglian Region: Current Trends and Remedies under Investigation,
W79-04570 5A

A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

Pollution of a Water Supply Catchment by Breeding Gulls and the Potential Environmental Health Implications,
W79-04843 5B

ENTEROMORPHA
Edible-Oil Pollution on Fanning Island,
W79-04841 5B

ENTRAINMENT
Impingement and Entrainment of Fishes at the Savannah River Plant and NPDES 316b Demonstration,
W79-04879 5B

ENVIRONMENT
IIASA Conference' 76.
W79-04686 6A

ENVIRONMENTAL EFFECTS
Effects of Geothermal Energy Development of Fish and Wildlife.
W79-04508 5C

A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

Oil Shale and the Environment,
W79-04522 6B

Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

Environmental Assessment of Coal Transportation,
W79-04531 5C

Distribution of Stable Organic Molecules in the Marine Environment: Physical Chemical Aspects. Chlorinated Hydrocarbons,
W79-04559 5C

Volatile Liquid Hydrocarbons in the Surface Coastal Waters of the Gulf of Mexico,
W79-04560 5C

A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

Added Chlorine in Aquatic Environments,
W79-04899 5C

Vertical Migration of Benthos in Simulated Dredged Material Overburdens; Vol. I: Marine Benthos,
W79-04931 5E

Development of Procedures for Selecting and Designing Reusable Dredged Material Disposal Sites,
W79-04934 5E

ENVIRONMENTAL ENGINEERING
Solution of Granular Bed Filtration Equations,
W79-04716 5F

ENZYMES
A Simple Method for Screening Petroleum Effluents by In Vitro Enzyme Inhibition,
W79-04902 5C

EPIPHYTES
Nitrogen-Fixation in the Littoral Benthos of an Oligotrophic Lake,
W79-04776 5C

EQUIPMENT
Factors Affecting Accuracy of Ichthyoplankton Samples Used in Power Plant Entrainment Studies,
W79-04504 5C

Sampling and Chemical Interpretation of Precipitation for Mass Balance Studies,
W79-04747 2B

A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

EROSION
Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

EROSION CONTROL
Corn Residue Management to Reduce Erosion in Irrigation Furrows,
W79-04724 4D

Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

Design and Operation of Gradient Terrace Systems,
W79-04918 2J

ESTIMATED COSTS
Estimating Costs for Water Treatment as a Function of Size and Treatment Plant Efficiency,
W79-04527 6B

ESTUARIES
Impact of Pesticides on the Marine Environment,
W79-04550 5C

Verification of an Estuarine Model for Apalachicola Bay, Florida,
W79-04582 2L

Transport of Nutrients and Carbon from the Nanaimo River to its Estuary,
W79-04726 2L

Factors Controlling the Estuarine Chemistry of Arsenic,
W79-04728 2L

Optics of Turbid Estuarine Waters: Approximations and Applications,
W79-04734 1A

Morphometry of a Tidal Mouth, According to its Discrete Model,
W79-04950 2L

EUCALANUS PILEATUS
Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

EUTROPHICATION
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

Quality Aspects of Agricultural Runoff and Drainage.
W79-04710 5B

Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

The Ecological History of a Mediaeval Man-Made Lake, Hickling Broad, Norfolk, United Kingdom,
W79-04777 5C

The Spring Phytoplankton Bloom in Lindaspollene, A Landlocked Norwegian Fjord. II. Biomass and Activity of Net-and Nanoplankton,
W79-04784 5C

Lead Accumulation in Plankton Blooms from Ullswater, The English Lake District,
W79-04819 5C

Evaluation of Aluminum Sulfate for Phosphorus Control in Eutrophic Lakes,
W79-04958 5C

EVALUATION
Comparison of Alternative Engineering Designs,
W79-04690 6A

A Proposed Method of Evaluating Flood Damages to Historic Homes--An Externality Approach,
W79-04702 6B

A Methodology for Determining Land Value and Associated Benefits Created from Dredged Material Containment,
W79-04933 5E

Recommended Procedures for the Testing and Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
W79-04944 3A

EVAPORATION
Measurement of Evaporation from Lakes and Ponds in Florida,
W79-04583 2D

EVAPORATORS
Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

EVAPOTRANSPIRATION
Estimating Evapotranspiration Rates for Corn in Delaware,
W79-04988 2D

EXPERIMENTAL ECOSYSTEM
The Development of Standard Laboratory and Field Ecosystem Research to Determine the Effects of Pollutants on the Marine Environment,
W79-04549 5C

EXPERIMENTAL ECOSYSTEMS
Impact of Metals on the Marine Environment,
W79-04552 5C

EXPONENTIALLY BROKEN ROD MODEL
Relative Abundance of Sympatric Species and Model of Exponentially Broken Rod (EBR),
W79-04541 5C

FACILITIES
Conceptual Design Study of a One Million Gallon Per Day MSM Desalination Plant Replacement for Demonstration Plant No. 2 at Point Loma, San Diego, California.
W79-04511 3A

FAIRFAX COUNTY
Flood-Plain Delineation for Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch Basins, Fairfax County, Virginia,
W79-04801 2E

FALLOUT
Nutrient Budget for a Residential Stormwater Catchment in Durban, South Africa,
W79-04565 5B

Atmospheric Fallout and Street Cleaning-Effects on Urban Storm Water and Snow,
W79-04568 5B

FANNING ISLAND
Edible-Oil Pollution on Fanning Island,
W79-04841 5B

FARM MANAGEMENT
Corn Residue Management to Reduce Erosion in Irrigation Furrows,
W79-04724 4D

FARM PONDS
Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

FARM WASTES
Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

FEASIBILITY
Methodology for Evaluation of Feasibility: Multijurisdictional Urban Drainage and Flood Control Projects.
W79-04502 6F

Comparison of Alternative Engineering Designs,
W79-04690 6A

FEASIBILITY STUDIES
A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

FEDERAL LAWS
Quality Aspects of Agricultural Runoff and Drainage.
W79-04710 5B

FEDERAL WATER POLLUTION CONTROL ACT
Federal Water Pollution Control Act: The Sections 316 (A) and 316 (B) Process,
W79-04507 6E

FEED CONVERSION RATIO
Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

FERTILITY
The Effect of Radioactive Pollution of Reservoirs on Fish,
W79-04543 5C

FIBER RECOVERY
Criteria for Selecting Installations for Fiber Recovery (Auswahlkriterien fuer Anlagen zur Faserrueckgewinnung),
W79-04633 5D

FILTERS
Solution of Granular Bed Filtration Equations,
W79-04716 5F

FILTRATION
Ultrafiltration: A Potential Method to Treat Poultry Processing Wastewater with Protein Recovered as the By-Product,
W79-04501 5D

Solution of Granular Bed Filtration Equations,
W79-04716 5F

FINITE ELEMENT ANALYSIS
Galerkin Finite Element Procedure for Analyzing Flow Through Random Media,
W79-04859 2F

FIRE
Institutional Change and Fire Management,
W79-04966 6E

A Policy-Oriented Simulation Model of Debris Production from a Chaparral-Covered Watershed,
W79-04967 6A

FISH
Effects of Geothermal Energy Development of Fish and Wildlife,
W79-04508 5C

A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

The Effect of Radioactive Pollution of Reservoirs on Fish,
W79-04543 5C

Tuberculation of Pearl Dace, Semotilus Margarita (Pisces: Cyprinidae),
W79-04663 6G

FISH BEHAVIOR
A Computer Monitored Aquatic Bioassay System,
W79-04652 5A

A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

FISH DIETS
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

FISH DISEASE
Studies on Toxic Effects of Pesticides on Fish - II Toxic Effects of the Herbicide, Benthiocarb, on Carp. (In Japanese),
W79-04826 5C

FISH DISEASES
Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

FISH FOOD ORGANISMS
Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

FISH KILL
Edible-Oil Pollution on Fanning Island,
W79-04841 5B

FISH MANAGEMENT
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

FISH PYSIOLOGY
Tuberculation of Pearl Dace, Semotilus Margarita (Pisces: Cyprinidae),
W79-04663 6G

FISH REPRODUCTION
Tuberculation of Pearl Dace, Semotilus Margarita (Pisces: Cyprinidae),
W79-04663 6G

FISH SAMPLING
Comparison of a High Volume Pump and Conventional Plankton Nets for Collecting Fish Larvae Entrained in Power Plant Cooling Systems,
W79-04703 5A

FIXED-BED MODELS
Predictive Model for Design of Fixed-Bed Adsorbers: Parameter Estimation and Model Development,
W79-04704 5D

FJORDS
The Spring Phytoplankton Bloom in Lindaspollene, A Landlocked Norwegian Fjord. II. Biomass and Activity of Net-and Nanoplankton,
W79-04784 5C

FLAGELLATES
Effect of Copper on Volume Regulation in the Marine Flagellate Dunaliella Marina,
W79-04972 5C

FLASH DISTILLATION
Development of Direct Contact Condensation Multistage Flash Distillation Process: Phase II
W79-04521 3A

Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

Saline Water Conversion Demonstration Plant Point Loma I, San Diego, California: Second Annual Report.
W79-04943 3A

FLOOD CONTROL
Methodology for Evaluation of Feasibility: Multijurisdictional Urban Drainage and Flood Control Projects.
W79-04502 6F

Walnut Creek Channel Improvement Project Contra Costa County, California; Hydraulic Model Investigation,
W79-04923 2E

FLOOD DAMAGE
A Proposed Method of Evaluating Flood Damages to Historic Homes--An Externality Approach,
W79-04702 6B

FLOOD DATA
Flood Plain Information: Big Thompson River Weld County, Colorado,
W79-04854 2E

Flood Plain Information: Tchefuncta River and Tributaries, Covington, LA.
W79-04855 2E

Flood Plain Information: Calcasieu River, Oakdale, Louisiana,
W79-04861 2E

Special Flood Hazard Information: Franklin Louisiana and Vicinity, Yokely Bayou and Bayou Teche.
W79-04864 2E

Flood Hazard Analyses: McKenzie River, Hendricks Bridge to Leaburg Dam, Lane County Oregon.
W79-04866 2E

FLOOD FLOW
Birth of a Parent: The Wakeby Distribution for Modeling Flood Flows,
W79-04742 2E

FLOOD FORECASTING
The Arno River Flood Study (1971-1976),
W79-04725 2E

Flood-Plain Delineation for Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch Basins, Fairfax County, Virginia,
W79-04801 2E

U.S. Geological Survey's Role in the Collection and Analysis of Peak-Flow Data on the Island of Oahu, Hawaii,
W79-04812 2E

Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

FLOOD FREQUENCY
The Incomplete Means Estimation Procedure Applied to Flood Frequency Analysis,
W79-04741 2E

Birth of a Parent: The Wakeby Distribution for Modeling Flood Flows,
W79-04742 2E

Application of the Frequency-Equivalent Non-Linear Hydrograph Method of Flood Frequency Analysis in Urban Basins,
W79-04788 2A

Flood-Plain Delineation for Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch Basins, Fairfax County, Virginia,
W79-04801 2E

Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

FLOOD PEAK
Flood Plain Information: Big Thompson River, Weld County, Colorado,
W79-04854 2E

FLOOD PLAIN INSURANCE
The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

FLOOD PLAIN MANAGEMENT
The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

Flood Plain Information: Salt Creek - Vicinity of Pueblo, Colorado.
W79-04865 2E

Flood Hazard Analyses: McKenzie River, Hedricks Bridge to Leaburg Dam, Lane County, Oregon.
W79-04866 2E

FLOOD-PLAIN MAPPING
Flood-Plain Delineation for Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch Basins, Fairfax County, Virginia,
W79-04801 2E

FLOOD PLAIN ZONING
Flood Plain Information: Salt Creek - Vicinity of Pueblo, Colorado.
W79-04865 2E

FLOOD PLAINS
Flood-Plain Delineation for Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch Basins, Fairfax County, Virginia,
W79-04801 2E

The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

Flood Hazard Study: Bark River, Village of Dousman and Vicinity, Waukesha County, Wisconsin.
W79-04863 2E

FLOOD PROFILES
Flood-Plain Delineation for Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch Basins, Fairfax County, Virginia,
W79-04801 2E

Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

Special Flood Hazard Information: Franklin, Louisiana and Vicinity, Yokely Bayou and Bayou Teche.
W79-04864 2E

Flood Hazard Analyses: McKenzie River, Hedricks Bridge to Leaburg Dam, Lane County, Oregon.
W79-04866 2E

FLOOD PROTECTION
The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

Flood Hazard Study: Bark River, Village of Dousman and Vicinity, Waukesha County, Wisconsin.
W79-04863 2E

Flood Plain Information: Salt Creek - Vicinity of Pueblo, Colorado.
W79-04865 2E

Flood Hazard Analyses: McKenzie River, Hedricks Bridge to Leaburg Dam, Lane County, Oregon.
W79-04866 2E

FLOOD RECURRENCE INTERVAL
U.S. Geological Survey's Role in the Collection and Analysis of Peak-Flow Data on the Island of Oahu, Hawaii,
W79-04812 2E

Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

FLOOD WAVES
The Arno River Flood Study (1971-1976),
W79-04725 2E

FLOODING
Flood Plain Information: Big Thompson River, Weld County, Colorado,
W79-04854 2E

Flood Plain Information: Tchefuncta River and Tributaries, Covington, LA.
W79-04855 2E

Flood Plain Information: Calcasieu River, Oakdale, Louisiana,
W79-04861 2E

Special Flood Hazard Information: Franklin, Louisiana and Vicinity, Yokely Bayou and Bayou Teche.
W79-04864 2E

Flood Plain Information: Salt Creek - Vicinity of Pueblo, Colorado.
W79-04865 2E

FLOODS
A Nonlinear Analysis of the Relationship Between Rainfall and Runoff for Extreme Floods,
W79-04604 2A

U.S. Geological Survey's Role in the Collection and Analysis of Peak-Flow Data on the Island of Oahu, Hawaii,
W79-04812 2E

Flood Hazard Study: Bark River, Village of Dousman and Vicinity, Waukesha County, Wisconsin.
W79-04863 2E

Flood Hazard Analyses: McKenzie River, Hedricks Bridge to Leaburg Dam, Lane County, Oregon.
W79-04866 2E

FLOODWAYS
The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

FLORIDA
Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

FLOW AUGMENTATION
Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

FLOW CHARACTERISTICS
Walnut Creek Channel Improvement Project, Contra Costa County, California; Hydraulic Model Investigation,
W79-04923 2E

FLOW DURATION
Flood Plain Information: Tchefuncta River and Tributaries, Covington, LA.
W79-04855 2E

FOAM FRACTIONATION
Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

FOAM SEPARATION
Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

FOOD CHAINS
Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

FOODS
Biosolids as Food,
W79-04638 5C

FORECASTING
Application of On-line Prediction Techniques to Forecasting Short Term Agricultural Water Demand,
W79-04689 6D

A Mathematical Deterministic River-Quality Model. Part I: Formulation and Description,
W79-04721 5B

Predictive Analyses of Ground-Water Discharges in the Willow Creek Watershed, Northeast Nebraska,
W79-04805 6A

FOREST MANAGEMENT
Institutional Change and Fire Management,
W79-04966 6E

A Policy-Oriented Simulation Model of Debris Production from a Chaparral-Covered Watershed,
W79-04967 6A

FOREST SOILS
Hydrologic Behavior of a Forested Mountain Soil in Coastal British Columbia,
W79-04564 2G

FOREST WATERSHEDS
Long-Term Patterns of Sediment Production Following Road Construction and Logging in the Oregon Coast Range,
W79-04750 2J

Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

FRANCE
Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary,
W79-04730 2L

FRANKLIN (LA)
Special Flood Hazard Information: Franklin, Louisiana and Vicinity, Yokely Bayou and Bayou Teche.
W79-04864 2E

FREEZING
Washing of Brine from Ice Crystals,
W79-04674 3A

FREQUENCY
Interstorm Relations in Pacific Northwest,
W79-04733 2B

FRESHWATER
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

FRESHWATER MARSH
The Relationship Between Aboveground and Belowground Biomass of Freshwater Tidal Wetland Macrophytes,
W79-04627 2I

FROZEN SOILS
Is the Soil Frozen or Not. An Algorithm Using Weather Records,
W79-04740 2G

FUCUS
Trace Metals in the Common Mussel, Mytilus Edulis (L.), and in the Alga Fucus Vesiculosus (L.) from the Region of the Sound (Oresund),
W79-04840 5B

FUELS
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

FURROW IRRIGATION
Corn Residue Management to Reduce Erosion in Irrigation Furrows,
W79-04724 4D

Sizing Tailwater Recovery Systems to Utilize Runoff from Precipitation on Irrigated Lands,
W79-04960 3F

Contour Furrow Irrigation with Liquid Manure Using 'Microtubing' for Flow Control,
W79-04982 3F

GAGES
A Note on the Dynamic Calibration of Tipping-Bucket Gauges,
W79-04903 2B

GALERKIN PROCEDURE
Galerkin Finite Element Procedure for Analyzing Flow Through Random Media,
W79-04859 2F

GALVESTON BAY
Habitat Development Field Investigations, Bolivar Peninsula Marsh and Upland Habitat Development Site, Galveston Bay, Texas; Appendix D: Propagation of Vascular Plants and Post-Propagation Monitoring of Botanical, Soil, Aquatic Biota, and Wildlife Resources,
W79-04927 5E

GAMBUSIA
Upgrading Faculative Wastewater Lagoons with Vascular Aquatic Plants,
W79-04830 5D

GAS-BUBBLE DISEASE
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

GAS-LIQUID RATIO
Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

GAS SCRUBBING
Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

GAS SUPERSATURATION
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

GASTEROSTEUS
A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

GEEPERS
An Evaluation of the Effects of Geothermal Energy Development on Aquatic Biota in the Geysers Area of California,
W79-04962 6G

GEOCHEMISTRY
The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

GEOMORPHOLOGY
Morphometry of a Tidal Mouth, According to its Discrete Model,
W79-04950 2L

GEORGIA
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

Factors Controlling the Estuarine Chemistry of Arsenic,
W79-04728 2L

GEORGIA BIGHT
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

GEOTHERMAL STUDIES
Effects of Geothermal Energy Development of Fish and Wildlife,
W79-04508 5C

Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

The Potential Impacts on Aquatic Ecosystems from the Release of Trace Elements in Geothermal Fluids,
W79-04881 5B

GILLS
Zinc Content of the Gills of Rainbow Trout (S. Gairdneri) after Treatment with Zinc Solutions under Normoxic and Hypoxic Conditions,
W79-04836 5C

GOAL PROGRAMMING
A Viable Methodology to Implement the Principles and Standards,
W79-04692 6A

GONYAULAX
Paralytic Shellfish Toxins in the Sea Scallop, Placopecten Magellanicus, in the Bay of Fundy,
W79-04825 5A

GRANULAR MEDIA
Solution of Granular Bed Filtration Equations,
W79-04716 5F

GRAPHITIC OXIDE
Reverse Osmosis Membranes Containing Graphitic Oxide,
W79-04665 3A

GRAZING
Hydrologic Impact of Grazing Systems on Infiltration and Runoff: Development of a Model,
W79-04585 2A

Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

GREEN RIVER BASIN
Water Resources Data for Colorado, Water Year 1977--Volume 3. Dolores River Basin, Green River Basin, San Juan River Basin.
W79-04792 7C

GROUNDWATER
Nitrates in Water Supply Abstractions in the Anglian Region: Current Trends and Remedies under Investigation,
W79-04570 5A

Occurrence, Quantity, and Quality of Ground Water in Taylor County, Texas.
W79-04575 2F

The Water Witch: Fact . . . or Fiction.
W79-04578 7B

Chemical Precipitation-Coagulation for Organic Color Removal from Groundwaters,
W79-04614 5F

The Computational Efficiency and Taylor Expansion Derivation of Approximating Equations to the Groundwater Flow Equation,
W79-04737 2F

Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

A New Function for Use in the Hodograph Method,
W79-04748 2F

Carbonate Chemistry of Groundwater from Tropical Tower Karst in South Thailand,
W79-04752 2F

Water Resources Data for Colorado, Water Year 1977--Volume 1. Missouri River Basin, Arkansas River Basin, Rio Grande Basin.
W79-04790 7C

Water Resources Data for Colorado, Water Year 1977--Volume 2. Colorado River Basin Above Dolores River.
W79-04791 7C

Water Resources Data for Colorado, Water Year 1977--Volume 3. Dolores River Basin, Green River Basin, San Juan River Basin.
W79-04792 7C

Summary of Hydrologic Data Collected During 1976 in Dade County, Florida.
W79-04795 7C

Hydrologic Appraisal of the Water Resources of the Homer-Preble Valley, New York,
W79-04796 6D

Water-Level Declines in the Madison Area, Dane County, Wisconsin,
W79-04809 7C

Computer Model of Two-Dimensional Solute Transport and Dispersion in Ground Water,
W79-04813 6A

Mathematical Methods for Analysis of Fresh Water Lenses in the Coastal Zones of the Floridan Aquifer,
W79-04961 4B

Groundwater and Salinity in the Grand Valley of Colorado,
W79-04985 5G

GROUNDWATER AVAILABILITY

Occurrence, Quantity, and Quality of Ground Water in Taylor County, Texas.
W79-04575 2F

Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

GROUNDWATER MINING

Preliminary Assessment of Policy and Management Options for Groundwater Mining in the Great Plains,
W79-04957 4B

GROUNDWATER MOUNDS

Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

GROUNDWATER MOVEMENT

Improvement of the Steady Floating Random Walk Monte Carlo Method Near Straight Line and Circular Boundaries with Application to Groundwater Flow,
W79-04557 2F

The Computational Efficiency and Taylor Expansion Derivation of Approximating Equations to the Groundwater Flow Equation,
W79-04737 2F

A New Function for Use in the Hodograph Method,
W79-04748 2F

Stochastic Analysis of Spatial Variability in Subsurface Flows 2. Evaluation and Application,
W79-04753 2F

Galerkin Finite Element Procedure for Analyzing Flow Through Random Media,
W79-04859 2F

GROUNDWATER POTENTIAL

Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

GROUNDWATER RESOURCES

Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

Public Groundwater Supplies in Warren County,
W79-04720 7C

Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

Water-Quality Investigation of the Yellville Watershed, Arkansas,
W79-04802 7C

GROWTH KINETICS

Kinetic Analysis of Interactive Effects of Cadmium and Nitrate on Growth of Thalassiosira Fluviatilis (Bacillariophyceae),
W79-04587 5A

GROWTH RATES

A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

Effects of Lead on Growth of the Marine Diatom Skeletonema Costatum,
W79-04600 5C

Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

The Productivity of Mesocyclops Leuckarti (Claus) in Lake Kinneret (Israel),
W79-04773 5C

Biological Control of Dissolved Aluminum in Seawater: Experimental Evidence,
W79-04824 5D

The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

Chronic Exposure of Channel Catfish, Ictalurus Punctatus, to Ammonia: Effects on Growth and Survival,
W79-04835 5C

The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

Temperature Influences on Growth of Aquatic Organisms,
W79-04851 5C

GROWTH STAGES

The Biology, Ecology, and Behavior of the Bivalve Mysella Bidentata (Montagu),
W79-04764 5C

The Productivity of Mesocyclops Leuckarti (Claus) in Lake Kinneret (Israel),
W79-04773 5C

The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

GULF GENERAL ATOMIC HIGH-FLUX PERCHLORATE MEMBRANE

Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

GULF STREAM

Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

GULLS

No. 2 Fuel Oil Decreases Embryonic Survival of Great Black-Backed Gulls,
W79-04628 5C

Pollution of a Water Supply Catchment by Breeding Gulls and the Potential Environmental Health Implications,
W79-04843 5B

GYPSUM

Calcium-Supplying Characteristics of Two Gypsum Materials on Southeastern Coastal Plain Soils,
W79-04662 2G

Phosphate Removal Using Waste Calcium Sulfate,
W79-04977 5D

HABITATS

A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

Habitat Development Field Investigations, Bolivar Peninsula Marsh and Upland Habitat Development Site, Galveston Bay, Texas; Appendix D: Propagation of Vascular Plants and Post-Propagation Monitoring of Botanical, Soil, Aquatic Biota, and Wildlife Resources,
W79-04927 5E

HALIMEDA TUNA

Occurrence of Endophytic Bacteria in Siphonous Algae,
W79-04783 5C

HARBORS

Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

Stony Brook Harbor: An Interdisciplinary Analysis,
W79-04862 6B

HAWAII

U.S. Geological Survey's Role in the Collection and Analysis of Peak-Flow Data on the Island of Oahu, Hawaii,
W79-04812 2E

HAY

Nitrogen Sources for Hay Production on Flooded Meadows,
W79-04653 3F

HAZARDOUS MATERIALS

Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

HEAT EXCHANGERS

Heat Transfer in the Liquid-Liquid Spray Tower,
W79-04670 3A

Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

HEATED WATER

Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

HEAVY METALS

Impact of Metals on the Marine Environment,
W79-04552 5C

Effects of Heavy Metals Especially Selenium, Vanadium and Zirconium on Movement, Growth and Survival of Certain Animal Aquatic Life,
W79-04592 5C

Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

HEAVY METALS

Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

Trace Metals in the Common Mussel, Mytilus Edulis (L.), and in the Alga Fucus Vesiculosus (L.) from the Region of the Sound (Oresund),
W79-04840 5B

The Effect of Recreation on Water Quality,
W79-04963 5B

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

An Erosion Model for Arid Wildland Watersheds,
W79-04994 2J

HEMATOLOGY

Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

HEMORRHAGE

Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

HEPTACHLOR

Impact of Pesticides on the Marine Environment,
W79-04550 5C

HERBICIDES

Studies on Toxic Effects of Pesticides on Fish - II Toxic Effects of the Herbicide, Benthiocarb, on Carp. (In Japanese),
W79-04826 5C

Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

HETEROGENEITY

Galerkin Finite Element Procedure for Analyzing Flow Through Random Media,
W79-04859 2F

HETEROTROPHIC ORGANISMS

Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

HICKLING BROAD (UNITED KINGDOM)

The Ecological History of a Mediaeval Man-Made Lake, Hickling Broad, Norfolk, United Kingdom,
W79-04777 5C

HISTOLOGY

Studies on Toxic Effects of Pesticides on Fish - II Toxic Effects of the Herbicide, Benthiocarb, on Carp. (In Japanese),
W79-04826 5C

HISTORIC FLOODS

Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

HISTORIC HOMES

A Proposed Method of Evaluating Flood Damages to Historic Homes--An Externality Approach,
W79-04702 6B

HISTORY

The Ecological History of a Mediaeval Man-Made Lake, Hickling Broad, Norfolk, United Kingdom,
W79-04777 5C

HOMER-PREBLE VALLEY

Hydrologic Appraisal of the Water Resources of the Homer-Preble Valley, New York,
W79-04796 6D

HOT SPRINGS

An Evaluation of the Effects of Geothermal Energy Development on Aquatic Biota in the Geysers Area of California,
W79-04962 6G

HUMAN PATHOLOGY

Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

HUMAN POPULATIONS

Public Perceptions of Issues and Problems in the Lake Champlain Basin Area, A Summary,
W79-04558 2H

HUMAN SERVICES

IIASA Conference' 76.
W79-04686 6A

HUMAN SETTLEMENTS

IIASA Conference' 76.
W79-04686 6A

HUMIC ACID

Coal Humic Substances for the Treatment of Wastewater from Stack Gas Scrubbers, Coal Conversion Plants, and Other Coal Utilization Facilities,
W79-04554 5D

HUMIDITY

Water Absorption by Plants in a Dry Wind and Under Periodic Spraying with Water (In Russian),
W79-04707 3F

HURRICANES

Special Flood Hazard Information: Franklin, Louisiana and Vicinity, Yokely Bayou and Bayou Teche.
W79-04864 2E

HYDRAULIC GRADIENT

A Procedure for Interpolating the Depth Distribution of Soil Moisture Tension (In German),
W79-04723 8B

HYDRAULIC PROPERTIES

Galerkin Finite Element Procedure for Analyzing Flow Through Random Media,
W79-04859 2F

HYDRAZINE

Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

HYDROELECTRIC POWER

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Lower White River Basin, Missouri-Arkansas.
W79-04872 4A

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Upper White River Basin, Missouri and Arkansas.
W79-04873 4A

HYDROELECTRIC PROJECT LICENSING

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Lower White River Basin, Missouri-Arkansas.
W79-04872 4A

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Upper White River Basin, Missouri and Arkansas.
W79-04873 4A

HYDROGEOLOGY

Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

Predictive Analyses of Ground-Water Discharges in the Willow Creek Watershed, Northeast Nebraska,
W79-04805 6A

Geohydrology of the Northern Louisiana Salt-Dome Basin Pertinent to the Storage of Radioactive Wastes--A Progress Report,
W79-04810 5E

Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

HYDROGRAPHS

Optimal Sequence of Incremental Precipitation,
W79-04901 2A

HYDROLOGIC DATA

Water Resources Data for Colorado, Water Year 1977--Volume 1. Missouri River Basin, Arkansas River Basin, Rio Grande Basin.
W79-04790 7C

Water Resources Data for Colorado, Water Year 1977--Volume 2. Colorado River Basin Above Dolores River.
W79-04791 7C

Water Resources Data for Colorado, Water Year 1977--Volume 3. Dolores River Basin, Green River Basin, San Juan River Basin.
W79-04792 7C

Summary of Hydrologic Data Collected During 1976 in Dade County, Florida,
W79-04795 7C

HYDROLOGIC MODELS

Hydrologic Impact of Grazing Systems on Infiltration and Runoff: Development of a Model,
W79-04585 2A

HYDROLOGIC PROPERTIES

Hydrologic Behavior of a Forested Mountain Soil in Coastal British Columbia,
W79-04564 2G

Behavior of Water in Various States,
W79-04951 1A

HYDROLOGY

On the Use of a Main Trend for the Kriging Technique in Hydrology,
W79-04870 2F

Disaggregation of Streamflow Volumes,
W79-04878 2E

HYDROLYSIS

The Hydrolysis of Ammonium Ions in Sea Water-Experimental Confirmation of Predicted Constants at One Atmosphere Pressure,
W79-04844 5A

HYPOCHLOROUS ACID

Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

E-BRINE SYSTEMS
Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

E WASHING
Washing of Brine from Ice Crystals,
W79-04674 3A

E-WATER INTERFACES
Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

HTHYOPLANKTON
Factors Affecting Accuracy of Ichthyoplankton Samples Used in Power Plant Entrainment Studies,
W79-04504 5C

TALURUS
Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

TALURUS PUNCTATUS
Chronic Exposure of Channel Catfish, Ictalurus Punctatus, to Ammonia: Effects on Growth and Survival,
W79-04835 5C

LINOIS
Solar Energy Information and Data for Illinois,
W79-04719 2B

Public Groundwater Supplies in Warren County,
W79-04720 7C

Winter Storms and the Record-Breaking Winter in Illinois,
W79-04839 2B

Water-Oriented Outdoor Recreation in the Illinois River Basin (Appendix VI)--Illinois-Indiana-Wisconsin.
W79-04853 6B

Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

LINOIS RIVER BASIN
Water-Oriented Outdoor Recreation in the Illinois River Basin (Appendix VI)--Illinois-Indiana-Wisconsin.
W79-04853 6B

MPACT STUDIES
Report of the Denver Workshop on State-Local-Federal Relationships in Socioeconomic Impact Assessment,
W79-04858 6B

MPACTS
Report of the Denver Workshop on State-Local-Federal Relationships in Socioeconomic Impact Assessment,
W79-04858 6B

Improvements Needed in the Corps of Engineers' Regulatory Program for Protecting the Nation's Waters.
W79-04871 6B

MPORTED WATER
Water Law - Rights of Importers and Developers of Water. City and County of Denver v. Fulton Irrigating Ditch Co., 506 P.2d 144 (Colo. 1972),
W79-04594 6E

IMPROVEMENT PROGRAMS
Benefits and Costs of Water Quality Improvements,
W79-04699 6B

INACTIVATION
Inactivation of Polioviruses and Coxsackieviruses in Surface Water,
W79-04591 5B

INDIA
Social and Economic Aspects of Water Exploitation,
W79-04760 6B

INDIRECT FLOOD MEASUREMENT
Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

INDUSTRIAL WASTES
Phytoplankton Ecology of Vancouver Harbor,
W79-04617 5B

Use of Waste Heat for Production of Fresh Water,
W79-04676 3A

Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

Process for Treating Caustic Wash Solutions,
W79-04889 5D

Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

INDUSTRIAL WATER
Process for the Sequestration of Oxygen Dissolved in Water and Compositions Useful for Such Purpose,
W79-04884 5F

Treatment of Water,
W79-04885 5F

INDUSTRIAL WATER TREATMENT
Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

INFRARED RADIATION
On the Detection of Shallow Aquifers Using Thermal Infrared Imagery,
W79-04745 7B

INJECTION WELLS
Waste Injection into a Two-Phase Flow Field: Sand-Box and Hele-Shaw Models Study,
W79-04599 5E

INORGANIC COMPOUNDS
Investigation of Inorganic Ion Exchange Membranes for Electrodialysis Application,
W79-04942 3A

INSTITUTIONAL CONSTRAINTS
Environmental and Institutional Aspects of Irrigation Agriculture,
W79-04978 3F

INSTITUTIONS
Institutional Arrangements for Effective Water Management in Colorado,
W79-04503 6E

Water Management Policies and Instrument.
W79-04856 5G

INSTRUMENTATION
Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

INTERNATIONAL COOPERATION
First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms.
W79-04537 5C

Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

INTERSTATE COMMISSIONS
Institutional Concerns: The Delaware Experience,
W79-04804 4A

INVERTEBRATE DRIFT
Channelization and Invertebrate in Some Iowa Streams,
W79-04789 2E

INVERTEBRATES
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

ION ADSORPTION
Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

ION EXCHANGE
Ion-Exchange Pretreatment of Water After Resin Regeneration with Reverse Osmosis Reject Brine,
W79-04505 5F

Investigation of Inorganic Ion Exchange Membranes for Electrodialysis Application,
W79-04942 3A

ION TRANSPORT
Transport of Electrolytes Through Membrane Systems, Second Annual Report,
W79-04952 3A

IRON
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

IRRIGATED FARMS
Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

IRRIGATED LAND
Environmental and Institutional Aspects of Irrigation Agriculture,
W79-04978 3F

IRRIGATION
Social and Economic Aspects of Water Exploitation,
W79-04760 6B

Quantification of Rice Yield Benefits Attributable to Irrigation Water,
W79-04999 3F

IRRIGATION ECONOMICS
Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

IRRIGATION EFFECTS
Changes in Biochemical Characteristics of Chernozem Soils in the Region of the Western Slope of the Ural Mountains During Irrigation,
W79-04706 2G

Minimizing Salt in Return Flow Through Irrigation Management.
W79-04996 3F

IRRIGATION EFFICIENCY
Effects of Availability of Water on Irrigation Systems Operations,
W79-04683 3F

Optimal Irrigation Management Strategy Under Hydrologic and Irrigation Efficiency Uncertainty Regimes,
W79-04685 3F

Allocation Procedure of Water and Land Resources in Relation to Some Irrigation Quality Parameters,
W79-04700 6A

Computer Programming Solid Set Systems,
W79-04913 3F

Sizing Tailwater Recovery Systems to Utilize Runoff from Precipitation on Irrigated Lands,
W79-04960 3F

Assessing Trickle Emitter Application Uniformity,
W79-04990 3F

Potato and Lettuce Response to Irrigation Methods and Practices,
W79-04997 3F

IRRIGATION SYSTEMS
Uniformly Discharging Lateral Weirs,
W79-04573 8B

Effects of Availability of Water on Irrigation Systems Operations,
W79-04683 3F

Optimal Irrigation Management Strategy Under Hydrologic and Irrigation Efficiency Uncertainty Regimes,
W79-04685 3F

Application of On-line Prediction Techniques to Forecasting Short Term Agricultural Water Demand,
W79-04689 6D

IRRIGATION WATER
Estimation of Urban Irrigation Water Use and Requirement,
W79-04984 3D

IRRIGATON PRACTICES
Economic Analyses of Multiple Pivot Irrigaton on a Droughty Soil,
W79-04995 3F

ISLAND OF OAHU
U.S. Geological Survey's Role in the Collection and Analysis of Peak-Flow Data on the Island of Oahu, Hawaii,
W79-04812 2E

ITALY
The Arno River Flood Study (1971-1976),
W79-04725 2E

JUVENILE FISH
Entrainment of Larval Fish by the Douglas Point Generating Station, Lake Huron, in Relation to Seasonal Succession and Distribution,
W79-04816 5C

KANSAS
Loss of High Flows by Seepage from Stream Channels in Kansas,
W79-04577 4A

KARST
Carbonate Chemistry of Groundwater from Tropical Tower Karst in South Thailand,
W79-04752 2F

KINETICS
Predictive Model for Design of Fixed-Bed Adsorbers: Parameter Estimation and Model Development,
W79-04704 5D

KOPPER HYDRATE PROCESS
The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-04671 3A

LABORATORY TESTS
The Development of Standard Laboratory and Field Ecosystem Research to Determine the Effects of Pollutants on the Marine Environment,
W79-04549 5C

Sluice Gates with High Discharge Coefficients,
W79-04572 8C

An Automated Device (AGARS) for Studying Avoidance of Pollutant Gradients by Aquatic Organisms,
W79-04696 5A

Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary,
W79-04730 2L

Recommended Procedures for the Testing and Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
W79-04944 3A

LAKE BUTTE DES MORTS (WI)
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

LAKE HURON
Entrainment of Larval Fish by the Douglas Point Generating Station, Lake Huron, in Relation to Seasonal Succession and Distribution,
W79-04816 5C

LAKE KINNERET (ISRAEL)
The Productivity of Mesocyclops Leuckarti (Claus) in Lake Kinneret (Israel),
W79-04773 5C

LAKE MEAD (NEVADA-ARIZONA)
Limnological Aspects of Lake Mead, Nevada-Arizona,
W79-04506 2H

LAKE MICHIGAN
Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

LAKE MICHIGAN (IL)
Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

LAKE POWELL (CO)
Water Policy and Decision-Making in the Colorado River Basin,
W79-04868 6E

LAKE POYGAN (WI)
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

LAKE RESTORATION
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

LAKE STURGEON
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

LAKE SUPERIOR
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

LAKE WINNECONNE (WI)
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

LAKES
Public Perceptions of Issues and Problems in the Lake Champlain Basin Area, A Summary,
W79-04558 2H

An Analysis of Playa Lake Water Utilization on the Texas High Plains,
W79-04611 6E

Phosphorus Loadings to Lakes and Some of Their Responses. Part 1. A New Calculation of Phosphorus Loading and Its Application to 13 New York Lakes,
W79-04621 5B

Phosphorus Loadings to Lakes and Some of Their Responses. Part 2. Regression Models of Summer Phytoplankton Standing Crops, Winter Total P, and Transparency of New York Lakes with Known Phosphorus Loadings,
W79-04622 5B

Input for a Stochastic Control Model of P Loading,
W79-04623 5B

Dissolved Oxygen Demand of Reduced Chemical Species in the Water Column of Sebasticook Lake, Maine,
W79-04684 2H

Three-Dimensional Temperature Model for Shallow Lakes,
W79-04731 5B

Postimpoundment Survey of Water-Quality Characteristics of Raystown Lake, Huntington and Bedford Counties, Pennsylvania,
W79-04806 2H

LAND
A Methodology for Determining Land Value and Associated Benefits Created from Dredged Material Containment,
W79-04933 5E

LAND MANAGEMENT
Application of Land Treatment for Water Quality Improvement,
W79-04905 5G

LAND RESOURCES
Allocation Procedure of Water and Land Resources in Relation to Some Irrigation Quality Parameters,
W79-04700 6A

LAND USE
Water in Land Use Planning.
W79-04681 6A

Analyzing the Impact of Land Use on Sewer Service Area Planning,
W79-04701 6A

Stony Brook Harbor: An Interdisciplinary Analysis,
W79-04862 6B

Case Studies and Comparative Analyses of Issues Associated with Productive Land Use at Dredged Material Disposal Sites,
W79-04926 5E

LANDSCAPING
Estimation of Urban Irrigation Water Use and Requirement,
W79-04984 3D

LARVAL GROWTH STAGE
Comparison of a High Volume Pump and Conventional Plankton Nets for Collecting Fish Larvae Entrained in Power Plant Cooling Systems,
W79-04703 5A

LATERAL WEIRS
Uniformly Discharging Lateral Weirs,
W79-04573 8B

LAWNS
Estimation of Urban Irrigation Water Use and Requirement,
W79-04984 3D

LEACHING
The Role of Plant Residues in the Fate of Cadmium in Ecosystems. A Buffer Against Contamination of Water Sources,
W79-04584 5B

Management for Minimizing Nitrogen Leaching Losses on Irrigated Sandy Soils,
W79-04980 3F

Minimizing Salt in Return Flow Through Irrigation Management.
W79-04996 3F

LEAD
Effects of Lead on Growth of the Marine Diatom Skeletonema Costatum,
W79-04600 5C

Lead Accumulation in Plankton Blooms from Ullswater, The English Lake District,
W79-04819 5C

Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

The Effect of Recreation on Water Quality,
W79-04963 5B

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

LEPOMIS
Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

LETTUCE
Potato and Lettuce Response to Irrigation Methods and Practices,
W79-04997 3F

LIFE CYCLES
Life Cycles and Population Dynamics of Marine Benthic Bivalves from the Disko Bugt Area of West Greenland,
W79-04767 5C

LIFE HISTORY STUDIES
The Biology, Ecology, and Behavior of the Bivalve Mysella Bidentata (Montagu),
W79-04764 5C

Life Cycles and Population Dynamics of Marine Benthic Bivalves from the Disko Bugt Area of West Greenland,
W79-04767 5C

The Productivity of Mesocyclops Leuckarti (Claus) in Lake Kinneret (Israel),
W79-04773 5C

Morphological Variation and Life History in Cylindrical Forms of Scytosiphon Lomentaria (Scytosiphonaceae: Phaeophyta) from Southern Australia,
W79-04778 5C

LIGNINS
Extracting Lignins from Mill Wastes,
W79-04640 5D

Mechanism of Aluminum Sulfate Recovery from Lignin Sludge (Mekhanism izvlecheniya sulfat alyuminiya iz shlam-lignina),
W79-04643 5D

LIMNOLOGY
Limnological Aspects of Lake Mead, Nevada-Arizona,
W79-04506 2H

Postimpoundment Survey of Water-Quality Characteristics of Raystown Lake, Huntington and Bedford Counties, Pennsylvania,
W79-04806 2H

LINDASPOLLENE (NORWAY)
The Spring Phytoplankton Bloom in Lindaspollene, A Landlocked Norwegian Fjord. II. Biomass and Activity of Net-and Nanoplankton,
W79-04784 5C

LINEAR PROGRAMMING
Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

LOIRE ESTUARY (FRANCE)
Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary,
W79-04730 2L

LONG-TERM PLANNING
Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

LONG-TUBE VERTICAL DISTILLATION
Fifth Annual Report, Saline Water Conversion Plant No. 1, Freeport, Texas.
W79-04519 3A

Fourth Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-04953 3A

LONGFIN DACE
Acute Toxicity of Copper, Zinc and Manganese in Single and Mixed Salt Solutions to Juvenile Longfin Dace, Agosia Chrysogaster,
W79-04833 5C

LOUISIANA
Geohydrology of the Northern Louisiana Salt-Dome Basin Pertinent to the Storage of Radioactive Wastes--A Progress Report,
W79-04810 5E

Flood Plain Information: Tchefuncta River and Tributaries, Covington, LA.
W79-04855 2E

Flood Plain Information: Calcasieu River, Oakdale, Louisiana,
W79-04861 2E

Special Flood Hazard Information: Franklin, Louisiana and Vicinity, Yokely Bayou and Bayou Teche.
W79-04864 2E

LOWER WHITE RIVER BASIN (MO & AR)
Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Lower White River Basin, Missouri-Arkansas.
W79-04872 4A

LUCIFERASE
Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

MACROCYSTIS ANGUSTIFOLIA
The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

MACROCYSTIS INTEGRIFOLIA
The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

MACROCYSTIS PYRIFERA
The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

MACROPHYTES
The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

MADISON AREA
Water-Level Declines in the Madison Area, Dane County, Wisconsin,
W79-04809 7C

MAGNESIUM
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

MALAYSIA
Notes on Freshwater Red Algae from West Malaysia,
W79-04768 5C

MANAGEMENT
On the Choice of the 'Appropriate Model' for Water Resources Planning and Management,
W79-04612 6A

IIASA Conference' 76.
W79-04686 6A

A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

MANGANESE
Acute Toxicity of Copper, Zinc and Manganese in Single and Mixed Salt Solutions to Juvenile Longfin Dace, Agosia Chrysogaster,
W79-04833 5C

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

MAPS
Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

MARINE ALGAE
Products of Photosynthesis in Natural Populations of Marine Phytoplankton from the Gulf of Maine,
W79-04763 5C

New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

MARINE BIOLOGY
Design of Simulation Models to Determine Biological Impact of Pollutants on the Marine Environment,
W79-04538 5C

Problems of Modeling the Effect of Pollution on Biological Systems of the Ocean,
W79-04539 5C

MARINE PLANTS
The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

MARSH MANAGEMENT
Design Concepts for In-Water Containment Structures for Marsh Habitat Development,
W79-04925 5E

MARSHES
Design Concepts for In-Water Containment Structures for Marsh Habitat Development,
W79-04925 5E

MASS TRANSFER
The Mechanism of Mass Transfer Through a Liquid Interface,
W79-04666 3A

Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

Energy and Mass Transfer in Partial-Pressure Distillation,
W79-04940 3A

MASSACHUSETTS
Oil Spills: The Strategy of Recovery,
W79-04904 5C

MATHEMATICAL MODELS
Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

Design of Simulation Models to Determine Biological Impact of Pollutants on the Marine Environment,
W79-04538 5C

Problems of Modeling the Effect of Pollution on Biological Systems of the Ocean,
W79-04539 5C

Relative Abundance of Sympatric Species and Model of Exponentially Broken Rod (EBR),
W79-04541 5C

Improvement of the Steady Floating Random Walk Monte Carlo Method Near Straight Line and Circular Boundaries with Application to Groundwater Flow,
W79-04557 2F

Enhancement of Water-Quality Monitoring Systems by Incorporating Water-Quality Modelling and Time-Series Analysis,
W79-04571 5B

Sewer Network Scheme for Digital Computations,
W79-04590 5D

A Simplified Model of Corn Growth Under Moisture Stress,
W79-04607 2D

Phosphorus Loadings to Lakes and Some of Their Responses. Part 2. Regression Models of Summer Phytoplankton Standing Crops, Winter Total P, and Transparency of New York Lakes with Known Phosphorus Loadings,
W79-04622 5B

Input for a Stochastic Control Model of P Loading,
W79-04623 5B

Mathematical Modeling of Pesticides in the Environment,
W79-04648 5B

Basic Mathematical Models of Toxicant Transport Through the Soil Profile,
W79-04649 5B

Optimal Irrigation Management Strategy Under Hydrologic and Irrigation Efficiency Uncertainty Regimes,
W79-04685 3F

A Mathematical Deterministic River-Quality Model. Part I: Formulation and Description,
W79-04721 5B

A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

The Incomplete Means Estimation Procedure Applied to Flood Frequency Analysis,
W79-04741 2E

On the Use of a Main Trend for the Kriging Technique in Hydrology,
W79-04870 2F

Optimal Sequence of Incremental Precipitation,
W79-04901 2A

Predicting and Simulating Pesticide Transport from Agricultural Land: Mathematical Model Development and Testing,
W79-04920 5B

MATHEMATICS
Solution of Granular Bed Filtration Equations,
W79-04716 5F

MAXIMUM PROBABLE FLOOD
Optimal Sequence of Incremental Precipitation,
W79-04901 2A

MCKENZIE RIVER (OR)
Flood Hazard Analyses: McKenzie River, Hedricks Bridge to Leaburg Dam, Lane County, Oregon.
W79-04866 2E

MEASUREMENT
American Methods for Measuring Phytoplankton Production in the Open Ocean,
W79-04540 5C

MEMBRANE
A Pilot Plant Study to Provide Improved Quality Feed Water for the Webster, South Dakota Electrodialysis Plant,
W79-04510 5F

MEMBRANE PROCESS
Reverse Osmosis for Water Desalination,
W79-04516 3A

MEMBRANE PROCESSES
Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II,
W79-04517 3A

New Synthetic Membranes for Reverse Osmosis Desalination,
W79-04520 3A

Anaerobic Digestion and Membrane Separation of Domestic Wastewater,
W79-04597 5D

Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

Recommended Procedures for the Testing and Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
W79-04944 3A

Transport of Electrolytes Through Membrane Systems, Second Annual Report,
W79-04952 3A

MEMBRANES
Reverse Osmosis for Water Desalination,
W79-04516 3A

Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II,
W79-04517 3A

New Synthetic Membranes for Reverse Osmosis Desalination,
W79-04520 3A

Reverse Osmosis Membranes Containing Graphitic Oxide,
W79-04665 3A

A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

Permeability Requirements of Membranes for Use in Desalination by Reverse Osmosis,
W79-04679 3A

Investigation of Inorganic Ion Exchange Membranes for Electrodialysis Application,
W79-04942 3A

Recommended Procedures for the Testing and Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
W79-04944 3A

The Osmionic Process,
W79-04948 3A

Reverse Osmosis Membrane Regeneration,
W79-04954 3A

MERCED RIVER
Selected Water-Quality Data from the Merced River, California, November 1976 Through August 1977,
W79-04794 5B

MERCURY
Contents of Total Mercury, Alkyl Mercury, and Methyl Mercury in Some Coastal Fish and Shells,
W79-04589 5A

Behavior of Mercury in Bio-Systems II. Depuration of 203HG2+ in Various Trophic Levels,
W79-04619 5B

Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary,
W79-04730 2L

The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

MERCURY COMPOUNDS
Contents of Total Mercury, Alkyl Mercury, and Methyl Mercury in Some Coastal Fish and Shells,
W79-04589 5A

MESOCYCLOPS LEUCKARTI
The Productivity of Mesocyclops Leuckarti (Claus) in Lake Kinneret (Israel),
W79-04773 5C

METABOLISM
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

METABOLITES
Ammonia Production Rates of Artemia Salina Under Various Culture Conditions,
W79-04971 5B

METALS
Kinetic Analysis of Interactive Effects of Cadmium and Nitrate on Growth of Thalassiosira Fluviatilis (Bacillariophyceae),
W79-04587 5A

Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

METHODOLOGY
Methodology for Designing Cost-Effective Monitoring and Compliance Strategies for Pesticide Use,
W79-04524 6A

First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms.
W79-04537 5C

American Methods for Measuring Phytoplankton Production in the Open Ocean,
W79-04540 5C

A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

The Development of Standard Methods of Measuring Microbiological Production,
W79-04545 5C

Use of Biological Indicators for Monitoring Effect of Pollutants on the Marine Environment,
W79-04546 5C

Persistence Limits in Ecological Systems,
W79-04548 5C

The Development of Standard Laboratory and Field Ecosystem Research to Determine the Effects of Pollutants on the Marine Environment,
W79-04549 5C

Oil and Marine Organisms,
W79-04551 5C

Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

A Viable Methodology to Implement the Principles and Standards,
W79-04692 6A

An Automated Device (AGARS) for Studying Avoidance of Pollutant Gradients by Aquatic Organisms,
W79-04696 5A

A Proposed Method of Evaluating Flood Damages to Historic Homes--An Externality Approach,
W79-04702 6B

Comparison of a High Volume Pump and Conventional Plankton Nets for Collecting Fish Larvae Entrained in Power Plant Cooling Systems,
W79-04703 5A

Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

Continuous Standard Water Delivery System for Bioassays with Aquatic Organisms,
W79-04770 5C

A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

METHYLMERCURY
Contents of Total Mercury, Alkyl Mercury, and Methyl Mercury in Some Coastal Fish and Shells,
W79-04589 5A

MICRO ANALYSIS
A Model for Determining the Impact of Control Costs on Municipal Finances,
W79-04698 6C

MICROBIAL DEGRADATION
Cometabolism of Foreign Compounds,
W79-04658 5B

MICROORGANISMS
The Development of Standard Methods of Measuring Microbiological Production,
W79-04545 5C

Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

Oil and Marine Organisms,
W79-04551 5C

Inactivation of Polioviruses and Coxsackieviruses in Surface Water,
W79-04591 5B

MINE WASTES
Acute Toxicity of Copper, Zinc and Manganese in Single and Mixed Salt Solutions to Juvenile Longfin Dace, Agosia Chrysogaster,
W79-04833 5C

MINING
Environmental Assessment of Coal Transportation,
W79-04531 5C

MINNELUSA FORMATION
Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

MINNOWS
Toxic Effects of Zinc on Fathead Minnows Pimephales Promelas in Soft Water,
W79-04837 5C

MIRROR LAKE (NH)
Nitrogen-Fixation in the Littoral Benthos of an Oligotrophic Lake,
W79-04776 5C

MODE OF ACTION
Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

MODEL STUDIES
Sluice Gates with High Discharge Coefficients,
W79-04572 8C

Generalized Stability Analysis of Channel Banks,
W79-04574 8D

Verification of an Estuarine Model for Apalachicola Bay, Florida,
W79-04582 2L

The Application of Optimal Linear Regulator Theory to a Problem in Water Pollution,
W79-04596 7B

Waste Injection into a Two-Phase Flow Field: Sand-Box and Hele-Shaw Models Study,
W79-04599 5E

On the Choice of the 'Appropriate Model' for Water Resources Planning and Management,
W79-04612 6A

Predictive Model for Design of Fixed-Bed Adsorbers: Parameter Estimation and Model Development,
W79-04704 5D

The Arno River Flood Study (1971-1976),
W79-04725 2E

Effect of Salt Upon Hot-Water Dispersion in Well-Mixed Estuaries,
W79-04729 2L

Three-Dimensional Temperature Model for Shallow Lakes,
W79-04731 5B

Temporal Moments for Longitudinal Dispersion,
W79-04732 5B

The Computational Efficiency and Taylor Expansion Derivation of Approximating Equations to the Groundwater Flow Equation,
W79-04737 2F

The Incomplete Means Estimation Procedure Applied to Flood Frequency Analysis,
W79-04741 2E

Birth of a Parent: The Wakeby Distribution for Modeling Flood Flows,
W79-04742 2E

Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

A New Function for Use in the Hodograph Method,
W79-04748 2F

Numerical Model for Saturated-Unsaturated Flow in Deformable Porous Media. 3. Applications,
W79-04749 2G

Stochastic Analysis of Spatial Variability in Subsurface Flows 2. Evaluation and Application,
W79-04753 2F

Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development,
W79-04808 6A

On the Use of a Main Trend for the Kriging Technique in Hydrology,
W79-04870 2F

Disaggregation of Streamflow Volumes,
W79-04878 2E

Morphometry of a Tidal Mouth, According to its Discrete Model,
W79-04950 2L

A Policy-Oriented Simulation Model of Debris Production from a Chaparral-Covered Watershed,
W79-04967 6A

MOLINATE
Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

MOLLUSKS
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

MONIA
Annual Cycles of Some Cladocerans in a Polluted Stream,
W79-04820 5C

MONITORING
Methodology for Designing Cost-Effective Monitoring and Compliance Strategies for Pesticide Use,
W79-04524 6A

Enhancement of Water-Quality Monitoring Systems by Incorporating Water-Quality Modelling and Time-Series Analysis,
W79-04571 5B

Biological Surveillance of Rivers: A Biological Monitoring Handbook,
W79-04634 7B

MONTE CARLO METHOD
Improvement of the Steady Floating Random Walk Monte Carlo Method Near Straight Line and Circular Boundaries with Application to Groundwater Flow,
W79-04557 2F

Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

MORPHOLOGY
Cyclomorphosis in Daphnia Carinata King (Crustacea: Cladocera) from Two Adjacent Sewage Lagoons in South Australia,
W79-04821 5C

MORTALITY
No. 2 Fuel Oil Decreases Embryonic Survival of Great Black-Backed Gulls,
W79-04628 5C

Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

Studies on Toxic Effects of Pesticides on Fish - II Toxic Effects of the Herbicide, Benthiocarb, on Carp. (In Japanese),
W79-04826 5C

Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

Edible-Oil Pollution on Fanning Island,
W79-04841 5B

Impingement and Entrainment of Fishes at the Savannah River Plant and NPDES 316b Demonstration,
W79-04879 5B

MOUNTAIN VIEW (OK)
Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

MOVEMENT
A Computer Program for Simulating Salinity Loads in Streams,
W79-04800 5B

Behavior of Water in Various States,
W79-04951 1A

MULTI-PURPOSE PROJECTS
A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

MULTIATTRIBUTE UTILITY THEORY
Applying Multiattribute Utility Theory to Evaluation of Tisza River Basin Development Plans,
W79-04688 6A

MULTIPLE-PHASE EJECTOR DESALINATION SYSTEMS
Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

MULTIPLE-PURPOSE RESERVOIRS
The Effect of Recreation on Water Quality,
W79-04963 5B

MUNICIPAL FINANCES
A Model for Determining the Impact of Control Costs on Municipal Finances,
W79-04698 6C

MUNICIPAL WASTES
Municipal Wastewater Aquaculture,
W79-04528 5D

Fundamental Research Needs for Water and Wastewater Treatment Systems,
W79-04852 5D

MUNICIPAL WATER
Estimating Costs for Water Treatment as a Function of Size and Treatment Plant Efficiency,
W79-04527 6B

MUSSELS
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

Trace Metals in the Common Mussel, Mytilus Edulis (L.), and in the Alga Fucus Vesiculosus (L.) from the Region of the Sound (Oresund),
W79-04840 5B

Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

MUTATION
UV-Induced Developmental Abnormalities in the Filamentous Blue-Green Alga Nostoc Linckia,
W79-04779 5C

MYRIOPHYLLUM
The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

MYSELLA BIDENTATA
The Biology, Ecology, and Behavior of the Bivalve Mysella Bidentata (Montagu),
W79-04764 5C

MYTILUS
Trace Metals in the Common Mussel, Mytilus Edulis (L.), and in the Alga Fucus Vesiculosus (L.) from the Region of the Sound (Oresund),
W79-04840 5B

NANAIMO RIVER (BRITISH COLUMBIA)
Transport of Nutrients and Carbon from the Nanaimo River to its Estuary,
W79-04726 2L

NANNOPLANKTON
The Spring Phytoplankton Bloom in Lindaspollene, A Landlocked Norwegian Fjord. II. Biomass and Activity of Net-and Nanoplankton,
W79-04784 5C

NAPHTHALENE
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

NATURAL RECHARGE
Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

NAUPLII
Ammonia Production Rates of Artemia Salina Under Various Culture Conditions.
W79-04971 5B

NAVIGATIONAL SAFETY
Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

NEMATODES
Lake Nematode Population Increase Following Bypass of Secondary Effluent,
W79-04818 5C

NEPTUNIUM
Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

NEREIS
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species.
W79-04974 5C

NET PLANKTON
The Spring Phytoplankton Bloom in Lindaspollene, A Landlocked Norwegian Fjord. II. Biomass and Activity of Net-and Nanoplankton,
W79-04784 5C

NETWORK DESIGN
Sewer Network Scheme for Digital Computations,
W79-04590 5D

NEUTRALIZATION
Reagent-Free Method of Effluent Neutralization (Bezreagentnyi sposob neitralizatsii stochnykh vod),
W79-04642 5D

NEW ENGLAND
The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

NEW YORK
Stony Brook Harbor: An Interdisciplinary Analysis,
W79-04862 6B

NEWTON COUNTY (TX)
A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

NICKEL
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

NITRATES
Nitrate and Phosphorus Runoff Losses from Small Watersheds in Great Lakes Basin,
W79-04535 5C

Nitrates in Water Supply Abstractions in the Anglian Region: Current Trends and Remedies under Investigation,
W79-04570 5A

Kinetic Analysis of Interactive Effects of Cadmium and Nitrate on Growth of Thalassiosira Fluviatilis (Bacillariophyceae),
W79-04587 5A

Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

NITROGEN
Nutrient Effectiveness in Relation to Rates Applied for Pot Experiments: I. Nitrogen and Potassium,
W79-04992 2G

NITROGEN COMPOUNDS
Nitrogen Sources for Hay Production on Flooded Meadows,
W79-04653 3F

Chronic Exposure of Channel Catfish, Ictalurus Punctatus, to Ammonia: Effects on Growth and Survival,
W79-04835 5C

NITROGEN CYCLE
The Hydrolysis of Ammonium Ions in Sea Water-Experimental Confirmation of Predicted Constants at One Atmosphere Pressure,
W79-04844 5A

NITROGEN FIXATION
Nitrogen-Fixation in the Littoral Benthos of an Oligotrophic Lake,
W79-04776 5C

NITROGEN SOURCES
Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

NITZSCHIA
Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

NON-POINT POLLUTION
Application of Land Treatment for Water Quality Improvement,
W79-04905 5G

NON-POINT SOURCE POLLUTION
Simulation of Urban Non-Point Source Pollution,
W79-04609 5B

NORTH CAROLINA
Water Quality Planning in North Carolina,
W79-04922 6E

NORTHERN LOUISIANA SALT-DOME BASIN
Geohydrology of the Northern Louisiana Salt-Dome Basin Pertinent to the Storage of Radioactive Wastes--A Progress Report,
W79-04810 5E

NOSTOC LINCKIA
UV-Induced Developmental Abnormalities in the Filamentous Blue-Green Alga Nostoc Linckia,
W79-04779 5C

NUCLEAR POWER PLANTS
Entrainment of Larval Fish by the Douglas Point Generating Station, Lake Huron, in Relation to Seasonal Succession and Distribution,
W79-04816 5C

NUCLEAR POWERPLANTS
The Effects of Heated Effluents on the Production of Marine Plankton (Takahama Nuclear Power Station-I) (In Japanese),
W79-04842 5B

Impingement and Entrainment of Fishes at the Savannah River Plant and NPDES 316b Demonstration,
W79-04879 5B

The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

NUCLEAR REACTORS
Entrainment of Larval Fish by the Douglas Point Generating Station, Lake Huron, in Relation to Seasonal Succession and Distribution,
W79-04816 5C

Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

NUCLEAR WASTE
Geohydrology of the Northern Louisiana Salt-Dome Basin Pertinent to the Storage of Radioactive Wastes--A Progress Report,
W79-04810 5E

NUCLEAR WASTES
Impact of Radioactivity on the Marine Environment,
W79-04542 5C

NUCLEATION
Nucleation and Growth of Ice Crystals,
W79-04673 3A

NUTRIENT REMOVAL
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

Management for Minimizing Nitrogen Leaching Losses on Irrigated Sandy Soils,
W79-04980 3F

NUTRIENT REQUIREMENTS
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

NUTRIENTS
Nitrate and Phosphorus Runoff Losses from Small Watersheds in Great Lakes Basin,
W79-04535 5C

Nutrient Budget for a Residential Stormwater Catchment in Durban, South Africa,
W79-04565 5B

Determining Nutrient Loading from Rainfall and Runoff in Small Rivers,
W79-04566 5B

Transport of Nutrients and Carbon from the Nanaimo River to its Estuary,
W79-04726 2L

Seasonal Growth and Succession of Tropical and Introduced Phytoplankton Cultured in Deep Sea Water,
W79-04772 5C

Postimpoundment Survey of Water-Quality Characteristics of Raystown Lake, Huntington and Bedford Counties, Pennsylvania,
W79-04806 2H

OAKDALE (LA)
Flood Plain Information: Calcasieu River, Oakdale, Louisiana,
W79-04861 2E

OCEAN CURRENTS
Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

OCEAN THERMAL ENERGY CONVERSION (OTEC)
Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

OCEAN WAVES
Irregular Wave Runup and Overtopping,
W79-04814 2H

OCEANS
First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms.
W79-04537 5C

Problems of Modeling the Effect of Pollution on Biological Systems of the Ocean,
W79-04539 5C

American Methods for Measuring Phytoplankton Production in the Open Ocean.
W79-04540 5C

Impact of Radioactivity on the Marine Environment,
W79-04542 5C

Use of Biological Indicators for Monitoring Effect of Pollutants on the Marine Environment.
W79-04546 5C

The Development of Standard Laboratory and Field Ecosystem Research to Determine the Effects of Pollutants on the Marine Environment.
W79-04549 5C

Oil and Marine Organisms.
W79-04551 5C

Impact of Metals on the Marine Environment.
W79-04552 5C

Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

OGALLALA AQUIFER (TX)
Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

OIL
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

No. 2 Fuel Oil Decreases Embryonic Survival of Great Black-Backed Gulls,
W79-04628 5C

OIL BOOMS
Flotation Means for Barrier for Water Carried Pollutants and Method of Making Same,
W79-04891 5G

OIL-OXIDIZING MICROORGANISMS
Oil and Marine Organisms,
W79-04551 5C

OIL POLLUTION
Oil and Marine Organisms,
W79-04551 5C

Ultrasonic Oil Spill Removal,
W79-04882 5G

Determination of Petroleum Hydrocarbons in Water, Fish and Sediments Following the Ekofisk Blow-Out,
W79-04976 5A

OIL SHALE
Oil Shale and the Environment,
W79-04522 6B

OIL SPILLS
Edible-Oil Pollution on Fanning Island,
W79-04841 5B

Ultrasonic Oil Spill Removal,
W79-04882 5G

Oil Spills: The Strategy of Recovery,
W79-04904 5C

Determination of Petroleum Hydrocarbons in Water, Fish and Sediments Following the Ekofisk Blow-Out,
W79-04976 5A

OILY WATER
Edible-Oil Pollution on Fanning Island,
W79-04841 5B

OLIGOTROPHY
Nitrogen-Fixation in the Littoral Benthos of an Oligotrophic Lake,
W79-04776 5C

ON-SITE INVESTIGATIONS
Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary,
W79-04730 2L

Toward More Detailed Field Monitoring of Variable Source Areas,
W79-04739 2G

Morphometry of a Tidal Mouth, According to its Discrete Model,
W79-04950 2L

ON-SITE LABORATORIES
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

ON-SITE TESTS
The Development of Standard Laboratory and Field Ecosystem Research to Determine the Effects of Pollutants on the Marine Environment,
W79-04549 5C

OPERATING COSTS
Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

OPTICAL PROPERTIES
Optics of Turbid Estuarine Waters: Approximations and Applications,
W79-04734 1A

OPTIMUM DEVELOPMENT PLANS
Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

ORANGES
Drip Irrigation of Orange Trees in Humid Climate,
W79-04991 3F

OREGON
A Geographically Variable Water Quality Index Used in Oregon,
W79-04697 5A

Interstorm Relations in Pacific Northwest,
W79-04733 2B

Long-Term Patterns of Sediment Production Following Road Construction and Logging in the Oregon Coast Range,
W79-04750 2J

Flood Hazard Analyses: McKenzie River, Hedricks Bridge to Leaburg Dam, Lane County, Oregon.
W79-04866 2E

OREGON COAST RANGE
Long-Term Patterns of Sediment Production Following Road Construction and Logging in the Oregon Coast Range,
W79-04750 2J

ORGANIC COMPOUNDS
Distribution of Stable Organic Molecules in the Marine Environment: Physical Chemical Aspects. Chlorinated Hydrocarbons,
W79-04559 5C

Chemical Precipitation-Coagulation for Organic Color Removal from Groundwaters,
W79-04614 5F

ORGANIC WASTES
Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

Apparatus and Method for Treating Waste-Containing Liquors,
W79-04893 5D

ORGANOCHLORINE PESTICIDES
Estimation of Organochlorine Pesticide Loss in Surface Runoff Waters,
W79-04655 5B

Certain Laws of Organochlorine Pesticide Redistribution in the Soil-Water, Soil-Plant System,
W79-04921 5B

ORGANOPHOSPHORUS PESTICIDES
Hydrolytic and Photochemical Degradation of Organophosphorus Pesticides,
W79-04682 5B

OSMIONIC MEMBRANES
The Osmionic Process,
W79-04948 3A

OSMOREGULATION
Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

OSMOSIS
The Osmionic Process,
W79-04948 3A

OUTDOOR RECREATION
Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

OUTER CONTINENTAL SHELF
Distribution of Stable Organic Molecules in the Marine Environment: Physical Chemical Aspects. Chlorinated Hydrocarbons,
W79-04559 5C

Volatile Liquid Hydrocarbons in the Surface Coastal Waters of the Gulf of Mexico,
W79-04560 5C

A Simple Method for Screening Petroleum Effluents by In Vitro Enzyme Inhibition,
W79-04902 5C

Oil Spills: The Strategy of Recovery,
W79-04904 5C

OVERLAND FLOW
Deposition of Nonuniform Sediment on Concave Slopes,
W79-04917 2J

OVERTOPPING
Irregular Wave Runup and Overtopping,
W79-04814 2H

OXYGEN
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

OXYGEN DEMAND
The Influence of Temperature and Wet Weight on the Oxygen Demand of Rainbow Trout (Salmo Gairdneri R.) in Fresh Water,
W79-04832 5C

OXYGENATION
Laboratory Studies of Gas Tracers for Reaeration,
W79-04712 5A

PACIFIC NORTHWEST US
Interstorm Relations in Pacific Northwest,
W79-04733 2B

PALAEMONETES
Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

ALEOECOLOGY
The Ecological History of a Mediaeval Man-Made Lake, Hickling Broad, Norfolk, United Kingdom,
W79-04777 5C

ALEOLIMNOLOGY
The Ecological History of a Mediaeval Man-Made Lake, Hickling Broad, Norfolk, United Kingdom,
W79-04777 5C

ARKS
'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

ASTURES
Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

ATENTS
Ultrasonic Oil Spill Removal,
W79-04882 5G

Purifying Oil Shale Retort Water,
W79-04883 5D

Process for the Sequestration of Oxygen Dissolved in Water and Compositions Useful for Such Purpose,
W79-04884 5F

Treatment of Water,
W79-04885 5F

Sewage Treatment System,
W79-04886 5D

Water Purification by Reverse Osmosis,
W79-04887 3A

Apparatus for Treating Sewage,
W79-04888 5D

Process for Treating Caustic Wash Solutions,
W79-04889 5D

Process for the Purification of Greasy and Soiled Water Using a Heavy Solvent, and Apparatus for its Implementation,
W79-04890 5D

Flotation Means for Barrier for Water Carried Pollutants and Method of Making Same,
W79-04891 5G

Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

Apparatus and Method for Treating Waste-Containing Liquors,
W79-04893 5D

Process and Apparatus for Removing Impurities Dissolved in Water,
W79-04894 5D

Ion Exchange Process,
W79-04895 5D

Flash Reactor,
W79-04896 5D

Method for Detecting Water Pollutants,
W79-04897 5A

Reverse Osmosis Desalination Apparatus and Method,
W79-04898 3A

Bibliography of Membrane Technology Pertaining to Saline Water Desalination: Part II.
W79-04945 3A

PATH OF POLLUTANTS
Waste Injection into a Two-Phase Flow Field: Sand-Box and Hele-Shaw Models Study,
W79-04599 5E

Basic Mathematical Models of Toxicant Transport Through the Soil Profile,
W79-04649 5B

Hexachlorocyclohexane, Metaphos, and Chlorophos Decomposition in Soil and Their Migration with the Waters of Surface Runoff,
W79-04654 5B

Estimation of Organochlorine Pesticide Loss in Surface Runoff Waters,
W79-04655 5B

Pesticide Transport and Metabolism in Model Systems,
W79-04661 5B

Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development,
W79-04808 6A

Computer Model of Two-Dimensional Solute Transport and Dispersion in Ground Water,
W79-04813 6A

Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

PATHOLOGY
Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

PEACHES
Peach Tree Response to Drip Application of Water and Nutrients,
W79-04981 3F

PEAK DISCHARGE
U.S. Geological Survey's Role in the Collection and Analysis of Peak-Flow Data on the Island of Oahu, Hawaii,
W79-04812 2E

Flood Plain Information: Big Thompson River, Weld County, Colorado,
W79-04854 2E

Flood Plain Information: Calcasieu River, Oakdale, Louisiana,
W79-04861 2E

PELAGIC
American Methods for Measuring Phytoplankton Production in the Open Ocean,
W79-04540 5C

PENAEUS
Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

PENNSYLVANIA
Pennsylvania Annual Progress Report, 1978,
W79-04797 7C

PERFORMANCE
Reservoir System Operating Policy--Case Study,
W79-04616 6A

Economic Performance of Reservoirs a Sensitivity Analysis,
W79-04711 6B

PERIPHYTON
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

Nitrogen-Fixation in the Littoral Benthos of an Oligotrophic Lake,
W79-04776 5C

PERMEABILITY
Reverse Osmosis for Water Desalination,
W79-04516 3A

PERSISTENCE
Persistence Limits in Ecological Systems,
W79-04548 5C

PEST CONTROL
Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

PESTICIDE KINETICS
Basic Mathematical Models of Toxicant Transport Through the Soil Profile,
W79-04649 5B

Hexachlorocyclohexane, Metaphos, and Chlorophos Decomposition in Soil and Their Migration with the Waters of Surface Runoff,
W79-04654 5B

Transformation and Transport Processes in Aquatic Systems,
W79-04656 5B

Hydrolytic and Photochemical Degradation of Organophosphorus Pesticides,
W79-04682 5B

Predicting and Simulating Pesticide Transport from Agricultural Land: Mathematical Model Development and Testing,
W79-04920 5B

PESTICIDE RESIDUES
Pesticide Transport and Metabolism in Model Systems,
W79-04661 5B

Ambient Concentrations of PCBs in the Southeast from Storet Data and Selected EPA Studies,
W79-04848 5A

Certain Laws of Organochlorine Pesticide Redistribution in the Soil-Water, Soil-Plant System,
W79-04921 5B

Closed Form Solution for Pesticide Loss in Runoff Water,
W79-05000 5B

PESTICIDE TOXICITY
Mathematical Modeling of Pesticides in the Environment,
W79-04648 5B

On the Estimation of the Anthropogenic Pollution Effect on the Functional State of the Soil Microflora,
W79-04657 5C

PESTICIDES
Methodology for Designing Cost-Effective Monitoring and Compliance Strategies for Pesticide Use,
W79-04524 6A

Impact of Pesticides on the Marine Environment,
W79-04550 5C

Estimation of Organochlorine Pesticide Loss in Surface Runoff Waters,
W79-04655 5B

Hydrolytic and Photochemical Degradation of Organophosphorus Pesticides,
W79-04682 5B

General Laws of the Migration of Pesticide Residues in the Delta Landscape Under Irrigation,
W79-04919 5B

PH CONTROL
Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

PHAEOPHYTA
Morphological Variation and Life History in Cylindrical Forms of Scytosiphon Lomentaria (Scytosiphonaceae: Phaeophyta) from Southern Australia,
W79-04778 5C

New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

PHENOLS
Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

PHENOMONOLOGICAL ADMITTANCE COEFFICIENTS
Transport of Electrolytes Through Membrane Systems, Second Annual Report,
W79-04952 3A

PHOSPHATES
Phosphate Removal Using Waste Calcium Sulfate,
W79-04977 5D

PHOSPHORUS
Nitrate and Phosphorus Runoff Losses from Small Watersheds in Great Lakes Basin,
W79-04535 5C

Phosphorus Loadings to Lakes and Some of Their Responses. Part 1. A New Calculation of Phosphorus Loading and Its Application to 13 New York Lakes,
W79-04621 5B

Phosphorus Loadings to Lakes and Some of Their Responses. Part 2. Regression Models of Summer Phytoplankton Standing Crops, Winter Total P, and Transparency of New York Lakes with Known Phosphorus Loadings,
W79-04622 5B

Input for a Stochastic Control Model of P Loading,
W79-04623 5B

Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

Evaluation of Aluminum Sulfate for Phosphorus Control in Eutrophic Lakes,
W79-04958 5C

PHOTOCYNTHETIC PRODUCTS
Studies on 14CO2-Assimilation in Marine Rhodophyceae,
W79-04766 5C

PHOTOGRAMMETRY
Satellite Snow-Cover Observations in Arizona,
W79-04803 7B

PHOTOPERIODISM
Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

PHOTOSYNTHESIS
Dry Matter Production and Translocation in Maize Subjected to Drought During Grain Fill,
W79-04606 2I

Photosynthesis, Transpiration, and Leaf Elongation in Corn Seedlings at Suboptimal Soil Temperatures,
W79-04608 2I

Products of Photosynthesis in Natural Populations of Marine Phytoplankton from the Gulf of Maine,
W79-04763 5C

Studies on 14CO2-Assimilation in Marine Rhodophyceae,
W79-04766 5C

Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

Pathway and Products of CO2-Fixation by Green Prokaryotic Algae in the Cloacal Cavity of Diplosoma Virens,
W79-04787 5C

PHOTOXICITY
Sources, Levels, and Reactions of Boron in Florida Waters,
W79-04603 2K

PHYSICAL PROPERTIES
Selected Water-Quality Data from the Merced River, California, November 1976 Through August 1977,
W79-04794 5B

PHYSICOCHEMICAL PROPERTIES
Thermodynamic Properties of Saline Water,
W79-04941 3A

PHYTOGEOGRAPHY
New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

PHYTOPLANKTON
American Methods for Measuring Phytoplankton Production in the Open Ocean,
W79-04540 5C

Relative Abundance of Sympatric Species and Model of Exponentially Broken Rod (EBR),
W79-04541 5C

Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

Phytoplankton Ecology of Vancouver Harbor,
W79-04617 5B

Phosphorus Loadings to Lakes and Some of Their Responses. Part 2. Regression Models of Summer Phytoplankton Standing Crops, Winter Total P, and Transparency of New York Lakes with Known Phosphorus Loadings,
W79-04622 5B

Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

Products of Photosynthesis in Natural Populations of Marine Phytoplankton from the Gulf of Maine,
W79-04763 5C

Aspects of Water Column Primary Productivity in the Chukchi Sea During Summer,
W79-04765 5C

Seasonal Growth and Succession of Tropical and Introduced Phytoplankton Cultured in Deep Sea Water,
W79-04772 5C

Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

The Effects of Heated Effluents on the Production of Marine Plankton (Takahama Nuclear Power Station-I) (In Japanese),
W79-04842 5B

PILOT PLANTS
A Pilot Plant Study to Provide Improved Quality Feed Water for the Webster, South Dakota Electrodialysis Plant,
W79-04510 5F

PIMEPHALES
Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

PIMPEPHALES
Toxic Effects of Zinc on Fathead Minnows Pimephales Promelas in Soft Water,
W79-04837 5C

PIPELINES
Environmental Assessment of Coal Transportation,
W79-04531 5C

PIPES
Construction Costs for Municipal Wastewater Conveyance Systems: 1973-1977.
W79-04761 6B

PLANKTON
Lead Accumulation in Plankton Blooms from Ullswater, The English Lake District,
W79-04819 5C

PLANKTON NETS
Factors Affecting Accuracy of Ichthyoplankton Samples Used in Power Plant Entrainment Studies,
W79-04504 5C

PLANNING
On the Choice of the 'Appropriate Model' for Water Resources Planning and Management,
W79-04612 6A

Environmental Considerations in Three Infrastructure Planning Agencies: An Overview of Research Findings,
W79-04680 6E

Water in Land Use Planning.
W79-04681 6A

Tisza and Vistula River Basins: Case Studies,
W79-04687 6A

Applying Multiattribute Utility Theory to Evaluation of Tisza River Basin Development Plans,
W79-04688 6A

A Viable Methodology to Implement the Principles and Standards,
W79-04692 6A

A Geographically Variable Water Quality Index Used in Oregon,
W79-04697 5A

Analyzing the Impact of Land Use on Sewer Service Area Planning,
W79-04701 6A

Economic Issues Related to Large-Scale Water Transfers in the USA,
W79-04759 6D

Report of the Denver Workshop on State-Local-Federal Relationships in Socioeconomic Impact Assessment,
W79-04858 6B

Proceedings, Research Planning Conference on the Aquatic Plant Control Program, 3-7 October 1977.
W79-04932 4A

Summary Report of Phase II. Development of Techniques for Estimating the Potentials of Water Resources Development in Achieving National and Regional Social Goals.
W79-04965 6B

PLANT GROWTH

UV-Induced Developmental Abnormalities in the Filamentous Blue-Green Alga Nostoc Linckia,
W79-04779 5C

Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

PLANT MORPHOLOGY

Morphological Variation and Life History in Cylindrical Forms of Scytosiphon Lomentaria (Scytosiphonaceae: Phaeophyta) from Southern Australia,
W79-04778 5C

The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

PLANT PHYSIOLOGY

Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

PLASTIC PIPES

Failure Criteria for Corrugated-Plastic Drain Tubing,
W79-04979 8G

Prediction of Deflection for Corrugated Plastic Tubing,
W79-04983 8G

PLATYMONAS

Ammonia Production Rates of Artemia Salina Under Various Culture Conditions,
W79-04971 5B

PLAYAS

An Analysis of Playa Lake Water Utilization on the Texas High Plains,
W79-04611 6E

PLEOMORPHISM

Morphological Variation and Life History in Cylindrical Forms of Scytosiphon Lomentaria (Scytosiphonaceae: Phaeophyta) from Southern Australia,
W79-04778 5C

POLLUTANT IDENTIFICATION

Volatile Liquid Hydrocarbons in the Surface Coastal Waters of the Gulf of Mexico,
W79-04560 5C

Trace Elements in the Sediments of the Buffalo River, Arkansas,
W79-04956 5A

The Effect of Recreation on Water Quality,
W79-04963 5B

POLLUTANTS

First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms.
W79-04537 5C

Design of Simulation Models to Determine Biological Impact of Pollutants on the Marine Environment,
W79-04538 5C

The Interrelationships Among Chemical Parameters in Rivers--Analysing the Effect of Natural and Anthropogenic Sources,
W79-04569 5B

Edible-Oil Pollution on Fanning Island,
W79-04841 5B

Pollution of a Water Supply Catchment by Breeding Gulls and the Potential Environmental Health Implications,
W79-04843 5B

POLLUTION ABATEMENT

Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

Environmental Assessment of Coal Transportation,
W79-04531 5C

Persistence Limits in Ecological Systems,
W79-04548 5C

Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

POLYCHAETES

The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

Effects of Temperature and Salinity on the Life Cycle of Ophryotrocha Diadema (Polychaeta, Dorvilleidae),
W79-04823 5C

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

POLYCHLORINATED BIPHENYLS

Ambient Concentrations of PCBs in the Southeast from Storet Data and Selected EPA Studies,
W79-04848 5A

POLYMERS

Second Report on Fabrication and Evaluation of New Ultrathin Reverse Osmosis Membranes,
W79-04678 3A

POPULATION DYNAMICS

Life Cycles and Population Dynamics of Marine Benthic Bivalves from the Disko Bugt Area of West Greenland,
W79-04767 5C

PORE WATER

Delayed Aquifer Yield as a Phenomenon of Delayed Air Entry,
W79-04744 2G

POROUS MEDIA

Numerical Model for Saturated-Unsaturated Flow in Deformable Porous Media. 3. Applications,
W79-04749 2G

POST-IMPOUNDMENT

Postimpoundment Survey of Water-Quality Characteristics of Raystown Lake, Huntington and Bedford Counties, Pennsylvania,
W79-04806 2H

POTABLE WATER

Radon in Potable Water Supplies in Maine,
W79-04593 5B

Social and Economic Aspects of Water Exploitation,
W79-04760 6B

POTAMOGETON

The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

POTASSIUM

Nutrient Effectiveness in Relation to Rates Applied for Pot Experiments: I. Nitrogen and Potassium,
W79-04992 2G

POTATOES

Potato and Lettuce Response to Irrigation Methods and Practices,
W79-04997 3F

POULTRY WASTES

Ultrafiltration: A Potential Method to Treat Poultry Processing Wastewater with Protein Recovered as the By-Product,
W79-04501 5D

POWDER RIVER BASIN

Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

POWER PLANTS

Comparison of a High Volume Pump and Conventional Plankton Nets for Collecting Fish Larvae Entrained in Power Plant Cooling Systems,
W79-04703 5A

Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

POWERPLANTS
A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

PRE-TREATMENT (WATER)
Ion-Exchange Pretreatment of Water After Resin Regeneration with Reverse Osmosis Reject Brine,
W79-04505 5F

Donnan Softening as a Pretreatment to Desalination Processes,
W79-04949 3A

PRECIPITATION (ATMOSPHERIC)
Interstorm Relations in Pacific Northwest,
W79-04733 2B

Bulk Precipitation and Streamflow Quality Relationships in an Urban Area,
W79-04738 2E

Sampling and Chemical Interpretation of Precipitation for Mass Balance Studies,
W79-04747 2B

PREDATION
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

PREDREDGING STUDY
Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

PRESOIL CONSERVATION PROGRAM
Water-Quality Investigation of the Yellville Watershed, Arkansas,
W79-04802 7C

PRICES
Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

PRICING
'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

PRIMARY PRODUCTION
Phytoplankton Ecology of Vancouver Harbor,
W79-04617 5B

PRIMARY PRODUCTIVITY
First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms.
W79-04537 5C

American Methods for Measuring Phytoplankton Production in the Open Ocean,
W79-04540 5C

Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

Aspects of Water Column Primary Productivity in the Chukchi Sea During Summer,
W79-04765 5C

A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

PRINCIPLES AND STANDARDS
A Viable Methodology to Implement the Principles and Standards,
W79-04692 6A

PRIOR APPROPRIATION
Analysis of Alaska's Water Use Act and Its Interaction with Federal Reserved Water Rights,
W79-04959 6E

PRIORITIES
An Analytical Model for Establishing Water Resources Development Priorities,
W79-04586 6B

PROBABILITY THEORY
Disaggregation of Streamflow Volumes,
W79-04878 2E

PROBLEM IDENTIFICATION AND RANKING
Methodology for Designing Cost-Effective Monitoring and Compliance Strategies for Pesticide Use,
W79-04524 6A

PRODUCTIVITY
The Development of Standard Methods of Measuring Microbiological Production,
W79-04545 5C

The Productivity of Mesocyclops Leuckarti (Claus) in Lake Kinneret (Israel),
W79-04773 5C

PROJECT PLANNING
Environmental Considerations in Three Infrastructure Planning Agencies: An Overview of Research Findings,
W79-04680 6E

Case Studies and Comparative Analyses of Issues Associated with Productive Land Use at Dredged Material Disposal Sites,
W79-04926 5E

PROJECTIONS
Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development,
W79-04808 6A

PROJECTS
Comparison of Alternative Engineering Designs,
W79-04690 6A

Pennsylvania Annual Progress Report, 1978,
W79-04797 7C

PROKARYOTIC ALGAE
Pathway and Products of CO2-Fixation by Green Prokaryotic Algae in the Cloacal Cavity of Diplosoma Virens,
W79-04787 5C

PROTEINS
Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. II. Preliminary Investigation of Cadmium-Binding Proteins,
W79-04969 5A

PROTOTYPE TESTS
Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

PTEROCLADIA CAPILLACEA
Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

PUBLIC ACCESS
Problems of Public Access to Water in Texas Lakes and Streams: An Analysis,
W79-04555 6E

PUBLIC HEALTH
Paralytic Shellfish Toxins in the Sea Scallop, Placopecten Magellanicus, in the Bay of Fundy,
W79-04825 5A

Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

PUBLIC PARTICIPATION
Expression and Repression of Special Interests in Planning and Management of the Meramec Park Reservoir,
W79-04647 6B

Construction Costs for Municipal Wastewater Conveyance Systems: 1973-1977.
W79-04761 6B

PUBLICATIONS
Bibliography of the Literature on Dropwise Condensation, 1930-64,
W79-04669 3A

Bibliography of Membrane Technology Pertaining to Saline Water Desalination: Part II.
W79-04945 3A

PUEBLO (CO)
Flood Plain Information: Salt Creek - Vicinity of Pueblo, Colorado.
W79-04865 2E

PULP AND PAPER INDUSTRY
Papermaking Primary Sludges. Dewatering Studies Realized with Different Industrial Devices (Boues primaires de papeterie. Essais de deshydratation realises avec differents appareils industriels),
W79-04581 5D

Filter Belts vs. Pressure in Dewatering of Sludges,
W79-04641 5D

Dewatering of High-Ash Sediments of Effluents (Obezvozhivamie vysokozolinykh osadkov stochnykh vod),
W79-04644 5D

Research on Pulp and Paper Industry Water and Effluent Quality Problems -- A Review,
W79-04668 5C

PULP WASTES
The Impact of Turpentine Recovery on the Toxicity and BOD of Kraft Mill Effluents,
W79-04534 5C

Les Papeteries Du Bourray (France), an Example of Effective Treatment of Waste Waters (Les Papeteries du Bourray, un exemple d'epuration efficace des eaux residuaires).
W79-04561 5C

Pilot-Plant Study of Two-Stage Chemical-Biological Purification of Pulping Effluents at the Ostroleka Pulp and Paper Mill (Badania poltechniczne nad oczyszczaniem sciekow celulozowych z Ostroleckich Zakladow Celulozowo-Papierniczych w Ukladzie Dwustopniowym Chemiczno-Biologicznym),
W79-04631 5D

Criteria for Selecting Installations for Fiber Recovery (Auswahlkriterien fuer Anlagen zur Faserrueckgewinnung),
W79-04633 5D

Removal of Color from Carbonate Pulping Effluent -- The Calcium-Magnesium Coagulation Process,
W79-04635 5D

A Colorimetric Analysis for Abietic-Type Resin Acids in Pulping Effluents,
W79-04636 5A

Toxicity Removal by Primary Treatment (of Kraft Pulp Mill Effluent),
W79-04637 5D

Biosolids as Food,
W79-04638 5C

Extracting Lignins from Mill Wastes,
W79-04640 5D

Reagent-Free Method of Effluent Neutralization (Bezreagentnyi sposob neitralizatsii stochnykh vod),
W79-04642 5D

Mechanism of Aluminum Sulfate Recovery from Lignin Sludge (Mekhanism izvlecheniya sulfat alyuminiya iz shlam-lignina),
W79-04643 5D

Dynamics of Effluent Clarification (Dinamika osvetleniya stochnykhvod),
W79-04645 5D

Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

PUMPING
Water-Level Declines in the Madison Area, Dane County, Wisconsin,
W79-04809 7C

PYROLYSIS
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

RADIOACTIVE WASTES
Impact of Radioactivity on the Marine Environment,
W79-04542 5C

Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

RADIOACTIVITY EFFECTS
Impact of Radioactivity on the Marine Environment,
W79-04542 5C

The Effect of Radioactive Pollution of Reservoirs on Fish,
W79-04543 5C

RADIOECOLOGY
Impact of Radioactivity on the Marine Environment,
W79-04542 5C

RADIOISOTOPES
Impact of Radioactivity on the Marine Environment,
W79-04542 5C

Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

RADON
Radon in Potable Water Supplies in Maine,
W79-04593 5B

RAINBOW TROUT
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

The Influence of Temperature and Wet Weight on the Oxygen Demand of Rainbow Trout (Salmo Gairdneri R.) in Fresh Water,
W79-04832 5C

Zinc Content of the Gills of Rainbow Trout (S. Gairdneri) after Treatment with Zinc Solutions under Normoxic and Hypoxic Conditions,
W79-04836 5C

RAINFALL
Nutrient Budget for a Residential Stormwater Catchment in Durban, South Africa,
W79-04565 5B

A Nonlinear Analysis of the Relationship Between Rainfall and Runoff for Extreme Floods,
W79-04604 2A

Interstorm Relations in Pacific Northwest,
W79-04733 2B

RAINFALL FREQUENCY
Application of the Frequency-Equivalent Non-Linear Hydrograph Method of Flood Frequency Analysis in Urban Basins,
W79-04788 2A

RAINFALL-RUNOFF RELATIONSHIPS
Optimal Sequence of Incremental Precipitation,
W79-04901 2A

RAINY MOUNTAIN CREEK (OK)
Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

RAYSTOWN LAKE
Postimpoundment Survey of Water-Quality Characteristics of Raystown Lake, Huntington and Bedford Counties, Pennsylvania,
W79-04806 2H

RECEIVING WATER
Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

RECREATION
Legal Problems in Changing Uses or Coordinating Uses of Keyhole Reservoir,
W79-04595 6E

Water-Oriented Outdoor Recreation in the Illinois River Basin (Appendix VI)--Illinois-Indiana-Wisconsin.
W79-04853 6B

The Effect of Recreation on Water Quality,
W79-04963 5B

RECREATION DEMAND
'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

Water-Oriented Outdoor Recreation in the Illinois River Basin (Appendix VI)--Illinois-Indiana-Wisconsin.
W79-04853 6B

Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

RECREATION FACILITIES
Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

RECREATIONAL FACILITIES
Coastal Zone Plan Implementation,
W79-04709 6A

RED CLAY
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

REGIONAL DEVELOPMENT
Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

REGIONAL ECONOMICS
Economic Issues Related to Large-Scale Water Transfers in the USA,
W79-04759 6D

REGIONS
A Geographically Variable Water Quality Index Used in Oregon,
W79-04697 5A

REGRESSION ANALYSIS
Phosphorus Loadings to Lakes and Some of Their Responses. Part 2. Regression Models of Summer Phytoplankton Standing Crops, Winter Total P, and Transparency of New York Lakes with Known Phosphorus Loadings,
W79-04622 5B

REGULATION
Methodology for Designing Cost-Effective Monitoring and Compliance Strategies for Pesticide Use,
W79-04524 6A

Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

Institutional Concerns: The Delaware Experience.
W79-04804 4A

RELIABILITY
Economic Performance of Reservoirs a Sensitivity Analysis,
W79-04711 6B

REMOTE SENSING
On the Detection of Shallow Aquifers Using Thermal Infrared Imagery,
W79-04745 7B

Satellite Snow-Cover Observations in Arizona,
W79-04803 7B

Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

REPLICATION
A Proposed Method of Evaluating Flood Damages to Historic Homes--An Externality Approach,
W79-04702 6B

REPRODUCTION
The Effect of Radioactive Pollution of Reservoirs on Fish,
W79-04543 5C

The Biology, Ecology, and Behavior of the Bivalve Mysella Bidentata (Montagu),
W79-04764 5C

Morphological Variation and Life History in Cylindrical Forms of Scytosiphon Lomentaria (Scytosiphonaceae: Phaeophyta) from Southern Australia,
W79-04778 5C

Annual Cycles of Some Cladocerans in a Polluted Stream,
W79-04820 5C

RESEARCH EQUIPMENT
A Computer Monitored Aquatic Bioassay System,
W79-04652 5A

RESEARCH NEEDS
Fundamental Research Needs for Water and Wastewater Treatment Systems,
W79-04852 5D

RESEARCH PRIORITIES
The Development of Standard Methods of Measuring Microbiological Production,
W79-04545 5C

Fundamental Research Needs for Water and Wastewater Treatment Systems,
W79-04852 5D

An Analysis of Drought Research Needs for Colorado Agriculture,
W79-04964 3B

RESERVOIRS
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

The Effect of Radioactive Pollution of Reservoirs on Fish,
W79-04543 5C

Legal Problems in Changing Uses or Coordinating Uses of Keyhole Reservoir,
W79-04595 6E

Reservoir System Operating Policy--Case Study,
W79-04616 6A

Economic Performance of Reservoirs a Sensitivity Analysis,
W79-04711 6B

Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

A Socio-Economic Feasibility Study of the Proposed Rochester Dam,
W79-04869 6B

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Lower White River Basin, Missouri-Arkansas.
W79-04872 4A

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Upper White River Basin, Missouri and Arkansas.
W79-04873 4A

RESIN ACIDS
A Colorimetric Analysis for Abietic-Type Resin Acids in Pulping Effluents,
W79-04636 5A

RESOURCE ALLOCATION
Allocation Procedure of Water and Land Resources in Relation to Some Irrigation Quality Parameters,
W79-04700 6A

RESOURCES
IIASA Conference' 76.
W79-04686 6A

RESOURCES DEVELOPMENT
Oil Shale and the Environment,
W79-04522 6B

A Simple Method for Screening Petroleum Effluents by In Vitro Enzyme Inhibition,
W79-04902 5C

RESPIRATION
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

RETURN FLOW
Agriculture and Salinity,
W79-04659 5G

Minimizing Salt in Return Flow Through Irrigation Management.
W79-04996 3F

REVERSE OSMOSIS
Reverse Osmosis for Water Desalination,
W79-04516 3A

New Synthetic Membranes for Reverse Osmosis Desalination,
W79-04520 3A

Anaerobic Digestion and Membrane Separation of Domestic Wastewater,
W79-04597 5D

Application of Reverse Osmosis and Ultrafiltration to Purification of Pulp and Paper Industry Effluents. VI. Purification of Pulp Bleaching Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego),
W79-04632 5D

Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

Reverse Osmosis Membranes Containing Graphitic Oxide,
W79-04665 3A

A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

Second Report on Fabrication and Evaluation of New Ultrathin Reverse Osmosis Membranes,
W79-04678 3A

Permeability Requirements of Membranes for Use in Desalination by Reverse Osmosis,
W79-04679 3A

Reverse Osmosis Desalination Apparatus and Method,
W79-04898 3A

Water and Ion Flow Through Imperfect Osmotic Membranes,
W79-04937 3A

Recommended Procedures for the Testing and Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
W79-04944 3A

Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

Reverse Osmosis Membrane Regeneration,
W79-04954 3A

REVIEWS
Municipal Wastewater Aquaculture,
W79-04528 5D

Pennsylvania Annual Progress Report, 1978,
W79-04797 7C

Institutional Concerns: The Delaware Experience,
W79-04804 4A

RHODOPHYCEAE
Studies on 14CO2-Assimilation in Marine Rhodophyceae,
W79-04766 5C

RHODOPHYTA
Notes on Freshwater Red Algae from West Malaysia,
W79-04768 5C

Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

RICE
Drainage Requirements for Lowland Rice,
W79-04908 5G

Quantification of Rice Yield Benefits Attributable to Irrigation Water,
W79-04999 3F

RIO GRANDE BASIN
Water Resources Data for Colorado, Water Year 1977--Volume 1. Missouri River Basin, Arkansas River Basin, Rio Grande Basin.
W79-04790 7C

RIO GRANDE RIVER
Inactivation of Polioviruses and Coxsackieviruses in Surface Water,
W79-04591 5B

RIVER
The Interrelationships Among Chemical Parameters in Rivers--Analysing the Effect of Natural and Anthropogenic Sources,
W79-04569 5B

RIVER BASIN DEVELOPMENT
Applying Multiattribute Utility Theory to Evaluation of Tisza River Basin Development Plans
W79-04688 6A

Water Policy and Decision-Making in the Colorado River Basin,
W79-04868 6B

RIVER BASINS
Tisza and Vistula River Basins: Case Studies
W79-04687 6A

Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development,
W79-04808 6A

RIVER BEDS
The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

RIVERS
Determining Nutrient Loading from Rainfall and Runoff in Small Rivers,
W79-04566 5B

Nitrates in Water Supply Abstractions in the Anglian Region: Current Trends and Remedies under Investigation,
W79-04570 5A

Biological Surveillance of Rivers: A Biological Monitoring Handbook,
W79-04634 7B

A Mathematical Deterministic River-Quality Model. Part I: Formulation and Description,
W79-04721 5B

A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

Transport of Nutrients and Carbon from the Nanaimo River to its Estuary,
W79-04726 2L

A New Function for Use in the Hodograph Method,
W79-04748 2F

Notes on Freshwater Red Algae from West Malaysia,
W79-04768 5C

The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

ROCHESTER DAM (KY)
A Socio-Economic Feasibility Study of the Proposed Rochester Dam,
W79-04869 6B

ROOTED AQUATIC PLANTS
The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

RUNOFF
Nutrient Budget for a Residential Stormwater Catchment in Durban, South Africa,
W79-04565 5B

A Nonlinear Analysis of the Relationship Between Rainfall and Runoff for Extreme Floods,
W79-04604 2A

Quality Aspects of Agricultural Runoff and Drainage.
W79-04710 5B

Factors Affecting the Export of Nitrate-Nitrogen from Drainage Basins in Southern Ontario,
W79-04735 5B

General Laws of the Migration of Pesticide Residues in the Delta Landscape Under Irrigation,
W79-04919 5B

RUTHENIUM
Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

SALINE WATER
Second Two Years' Progress on Study and Field Evaluation of Solar Sea-Water Stills.
W79-04514 3A

The Effect of Salt Precipitation and High Sodium Concentrations on Soil Hydraulic Conductivity and Water Retention,
W79-04650 2G

Corrosion Test Program,
W79-04677 3A

Thermodynamic Properties of Saline Water,
W79-04941 3A

By-Products from Saline Water Conversion Plants: A Feasibility Study,
W79-04946 3A

Groundwater and Salinity in the Grand Valley of Colorado,
W79-04985 5G

SALINITY
A Computer Program for Simulating Salinity Loads in Streams,
W79-04800 5B

Effects of Temperature and Salinity on the Life Cycle of Ophryotrocha Diadema (Polychaeta, Dorvilleidae),
W79-04823 5C

SALINITY TRANSPORT
A Computer Program for Simulating Salinity Loads in Streams,
W79-04800 5B

SALMO GAIRDNERI
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

SALT CREEK (CO)
Flood Plain Information: Salt Creek - Vicinity of Pueblo, Colorado.
W79-04865 2E

SALT-VERDE WATERSHED
Satellite Snow-Cover Observations in Arizona,
W79-04803 7B

SAMPLING
Factors Affecting Accuracy of Ichthyoplankton Samples Used in Power Plant Entrainment Studies,
W79-04504 5C

Sampling and Chemical Interpretation of Precipitation for Mass Balance Studies,
W79-04747 2B

Method for Detecting Water Pollutants,
W79-04897 5A

SAN FRANCISCO BAY ESTUARY
Optics of Turbid Estuarine Waters: Approximations and Applications,
W79-04734 1A

SAN JUAN RIVER BASIN
Water Resources Data for Colorado, Water Year 1977--Volume 3. Dolores River Basin, Green River Basin, San Juan River Basin.
W79-04792 7C

SARGASSO SEA
Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

SATELLITES (ARTIFICIAL)
Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

SATURATED FLOW
Numerical Model for Saturated-Unsaturated Flow in Deformable Porous Media. 3. Applications,
W79-04749 2G

SCALLOPS
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

SCIRPUS
The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

SCYTOSIPHON LOMENTARIA
Morphological Variation and Life History in Cylindrical Forms of Scytosiphon Lomentaria (Scytosiphonaceae: Phaeophyta) from Southern Australia,
W79-04778 5C

SEA ICE
Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

SEA WATER
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

SEA WATER INTRUSION
Mathematical Methods for Analysis of Fresh Water Lenses in the Coastal Zones of the Floridan Aquifer,
W79-04961 4B

SEASONAL
Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

Cyclomorphosis in Daphnia Carinata King (Crustacea: Cladocera) from Two Adjacent Sewage Lagoons in South Australia,
W79-04821 5C

SEDIMENT CONTROL
Flat Channel Terraces for Pollution Abatement and Sediment Control,
W79-04914 4A

An Analysis of the Functional Capabilities and Performance of Silt Curtains.
W79-04924 5E

SEDIMENT TRANSPORT
Deposition of Nonuniform Sediment on Concave Slopes,
W79-04917 2J

SEDIMENTATION
Dynamics of Effluent Clarification (Dinamika osvetleniya stochnykhvod),
W79-04645 5D

Quality Aspects of Agricultural Runoff and Drainage.
W79-04710 5B

SEDIMENTATION PONDS
Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

SEDIMENTATION RATES
Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

The Ecological History of a Mediaeval Man-Made Lake, Hickling Broad, Norfolk, United Kingdom,
W79-04777 5C

SEDIMENTS
Long-Term Patterns of Sediment Production Following Road Construction and Logging in the Oregon Coast Range,
W79-04750 2J

SEEPAGE
Loss of High Flows by Seepage from Stream Channels in Kansas,
W79-04577 4A

Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

SELENASTRUM
Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

SELENIUM
Effects of Heavy Metals Especially Selenium, Vanadium and Zirconium on Movement, Growth and Survival of Certain Animal Aquatic Life,
W79-04592 5C

SEMIPERMEABLE MEMBRANES
Water and Ion Flow Through Imperfect Osmotic Membranes,
W79-04937 3A

SENSITIVITY
Comparison of Alternative Engineering Designs,
W79-04690 6A

SEPARATION COEFFICIENT
Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

SEPARATION TECHNIQUES
Extracting Lignins from Mill Wastes,
W79-04640 5D

SEPTIC TANKS
Anaerobic Digestion and Membrane Separation of Domestic Wastewater,
W79-04597 5D

Water-Conservation Methods to Meet Pennsylvania's Water Needs,
W79-04598 3D

SEWAGE
Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

SEWAGE DISPOSAL
Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

SEWAGE EFFLUENTS
Sources, Levels, and Reactions of Boron in Florida Waters,
W79-04603 2K

SEWAGE LAGOONS
Cyclomorphosis in Daphnia Carinata King (Crustacea: Cladocera) from Two Adjacent Sewage Lagoons in South Australia,
W79-04821 5C

Upgrading Faculative Wastewater Lagoons with Vascular Aquatic Plants,
W79-04830 5D

SEWAGE TREATMENT
Sewage Treatment System,
W79-04886 5D

Apparatus for Treating Sewage,
W79-04888 5D

SEWERAGE
Analyzing the Impact of Land Use on Sewer Service Area Planning,
W79-04701 6A

Construction Costs for Municipal Wastewater Conveyance Systems: 1973-1977.
W79-04761 6B

SEWERS
Sewer Network Scheme for Digital Computations,
W79-04590 5D

SHELLFISH
Contents of Total Mercury, Alkyl Mercury, and Methyl Mercury in Some Coastal Fish and Shells,
W79-04589 5A

SHELLFISH POISONING
Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

SHINERS
Ammonia Toxicity and pH Control in Fish Toxicity Bioassays of Treated Wastewaters,
W79-04817 5C

SHORE PROTECTION
Coastal Zone Plan Implementation,
W79-04709 6A

Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

SHORES
Economic Valuation of Shoreline,
W79-04620 6B

SHORT-TERM PLANNING
Application of On-line Prediction Techniques to Forecasting Short Term Agricultural Water Demand,
W79-04689 6D

SHRIMP
Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

SILT CURTAINS
An Analysis of the Functional Capabilities and Performance of Silt Curtains.
W79-04924 5E

SILTS
An Analysis of the Functional Capabilities and Performance of Silt Curtains.
W79-04924 5E

SILVER
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

SIMAZINE
Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

SIMULATION ANALYSIS
Design of Simulation Models to Determine Biological Impact of Pollutants on the Marine Environment,
W79-04538 5C

Simulation of Urban Non-Point Source Pollution,
W79-04609 5B

Reduction of Aqueous HOCl with Activated Carbon,
W79-04615 5F

Planning Storm-Drainage Systems for Urban Growth,
W79-04618 6F

Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

Economic Performance of Reservoirs a Sensitivity Analysis,
W79-04711 6B

SIPHONOUS ALGAE
Occurrence of Endophytic Bacteria in Siphonous Algae,
W79-04783 5C

SKELETONEMA
Effects of Lead on Growth of the Marine Diatom Skeletonema Costatum,
W79-04600 5C

Biological Control of Dissolved Aluminum in Seawater: Experimental Evidence,
W79-04824 5D

SLOPE STABILIZATION
Parallel Terraces on Flat Slopes,
W79-04915 4A

SLOPES
Generalized Stability Analysis of Channel Banks,
W79-04574 8D

SLUDGE
Mechanism of Aluminum Sulfate Recovery from Lignin Sludge (Mekhanism izvlecheniya sulfat alyuminiya iz shlam-lignina),
W79-04643 5D

SLUDGE DISPOSAL
Fundamental Research Needs for Water and Wastewater Treatment Systems,
W79-04852 5D

SLUDGE TREATMENT
Papermaking Primary Sludges. Dewatering Studies Realized with Different Industrial Devices (Boues primaires de papeterie. Essais de deshydratation realises avec differents appareils industriels),
W79-04581 5D

Filter Belts vs. Pressure in Dewatering of Sludges,
W79-04641 5D

Dewatering of High-Ash Sediments of Effluents (Obezvozhivamie vysokozolinykh osadkov stochnykh vod),
W79-04644 5D

Fundamental Research Needs for Water and Wastewater Treatment Systems,
W79-04852 5D

SLUICE GATES
Sluice Gates with High Discharge Coefficients,
W79-04572 8C

SMALL CRAFT HARBORS
Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

SMALL WATERSHEDS
Nitrate and Phosphorus Runoff Losses from Small Watersheds in Great Lakes Basin,
W79-04535 5C

SNOW
Winter Storms and the Record-Breaking Winter in Illinois,
W79-04839 2B

SNOW COVER
Satellite Snow-Cover Observations in Arizona,
W79-04803 7B

SNOW SURVEYS
Satellite Snow-Cover Observations in Arizona,
W79-04803 7B

SOCIAL ASPECTS
Social and Economic Aspects of Water Exploitation,
W79-04760 6B

SOCIAL IMPACT
A Socio-Economic Feasibility Study of the Proposed Rochester Dam,
W79-04869 6B

SOCIAL VALUES
'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

Summary Report of Phase II. Development of Techniques for Estimating the Potentials of Water Resources Development in Achieving National and Regional Social Goals.
W79-04965 6B

SOCIOECONOMIC IMPACTS
Report of the Denver Workshop on State-Local-Federal Relationships in Socioeconomic Impact Assessment,
W79-04858 6B

SOIL CONSERVATION
An Analysis of Drought Research Needs for Colorado Agriculture,
W79-04964 3B

SOIL EROSION
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

An Erosion Model for Arid Wildland Watersheds,
W79-04994 2J

SOIL LEACHING
Calcium-Supplying Characteristics of Two Gypsum Materials on Southeastern Coastal Plain Soils,
W79-04662 2G

SOIL MANAGEMENT
Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

SOIL MICROBIOLOGY
Cometabolism of Foreign Compounds,
W79-04658 5B

SOIL MICROORGANISM
On the Estimation of the Anthropogenic Pollution Effect on the Functional State of the Soil Microflora,
W79-04657 5C

SOIL MOISTURE
A Simplified Model of Corn Growth Under Moisture Stress,
W79-04607 2D

A Procedure for Interpolating the Depth Distribution of Soil Moisture Tension (In German),
W79-04723 8B

SOIL PHYSICAL PROPERTIES
Rate of Capillary Water Ascent as Dependent on Physical Soil Properties, (In Czech),
W79-04751 2G

SOIL WATER
Time-Dependent Solutions to the One-Dimensional Linearized Moisture Flow Equation with Water Extraction,
W79-04602 2G

Use of Methanol-Water Solutions for Freeze Protection of Tensiometers,
W79-04605 3F

Rapid Determination of Soil Water Characteristic by Thermocouple Psychrometry,
W79-04987 2G

SOIL WATER MOVEMENT
Hydrologic Behavior of a Forested Mountain Soil in Coastal British Columbia,
W79-04564 2G

Toward More Detailed Field Monitoring of Variable Source Areas,
W79-04739 2G

Delayed Aquifer Yield as a Phenomenon of Delayed Air Entry,
W79-04744 2G

SOIL-WATER-PLANT RELATIONSHIPS
The Effect of Salt Precipitation and High Sodium Concentrations on Soil Hydraulic Conductivity and Water Retention,
W79-04650 2G

An Analysis of Drought Research Needs for Colorado Agriculture,
W79-04964 3B

SOLAR DISTILLATION
Final Three Years' Progress on Study and Field Evaluation of Sea Water Stills.
W79-04512 3A

Research on Methods for Solar Distillation,
W79-04513 3A

Second Two Years' Progress on Study and Field Evaluation of Solar Sea-Water Stills.
W79-04514 3A

Energy and Mass Transfer in Partial-Pressure Distillation,
W79-04940 3A

SOLAR ENERGY
Solar Energy Information and Data for Illinois,
W79-04719 2B

SOLAR RADIATION
Solar Energy Information and Data for Illinois,
W79-04719 2B

SOLAR STILLS
Final Three Years' Progress on Study and Field Evaluation of Sea Water Stills.
W79-04512 3A

Research on Methods for Solar Distillation,
W79-04513 3A

Second Two Years' Progress on Study and Field Evaluation of Solar Sea-Water Stills.
W79-04514 3A

SOLID WASTES
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

SOUTH AFRICA
Nutrient Budget for a Residential Stormwater Catchment in Durban, South Africa,
W79-04565 5B

SOVIET UNION
First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms.
W79-04537 5C

The Development of Standard Methods of Measuring Microbiological Production,
W79-04545 5C

Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

SPATIAL DISTRIBUTION
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

SPEAR FISHING
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

SPECIES DIVERSITY
The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

SPISULA
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

SPORES
UV-Induced Developmental Abnormalities in the Filamentous Blue-Green Alga Nostoc Linckia,
W79-04779 5C

SPORT FISHING
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

SPRAY TOWER
Heat Transfer in the Liquid-Liquid Spray Tower,
W79-04670 3A

SPRINGFIELD AREA
Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

SPRINGS
Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

SPRINKLER IRRIGATION
Computer Programming Solid Set Systems,
W79-04913 3F

Assessing Trickle Emitter Application Uniformity,
W79-04990 3F

Drip Irrigation of Orange Trees in Humid Climate,
W79-04991 3F

Economic Analyses of Multiple Pivot Irrigaton on a Droughty Soil,
W79-04995 3F

STAGE-DISCHARGE RELATIONS
Flood Plain Information: Tchefuncta River and Tributaries, Covington, LA.
W79-04855 2E

Flood Plain Information: Calcasieu River, Oakdale, Louisiana,
W79-04861 2E

STATE LAWS
Coastal Zone Plan Implementation,
W79-04709 6A

STATISTICAL METHODS
Use of Biological Indicators for Monitoring Effect of Pollutants on the Marine Environment,
W79-04546 5C

STATISTICAL MODELS
Galerkin Finite Element Procedure for Analyzing Flow Through Random Media,
W79-04859 2F

STOCHASTIC PROCESSES
Problems of Modeling the Effect of Pollution on Biological Systems of the Ocean,
W79-04539 5C

Economic Performance of Reservoirs a Sensitivity Analysis,
W79-04711 6B

STONY BROOK HARBOR (NY)
Stony Brook Harbor: An Interdisciplinary Analysis,
W79-04862 6B

STORMS
Winter Storms and the Record-Breaking Winter in Illinois,
W79-04839 2B

STREAM
An Evaluation of the Effects of Geothermal Energy Development on Aquatic Biota in the Geysers Area of California,
W79-04962 6G

STREAM CLASSIFICATION
Water Quality Planning in North Carolina,
W79-04922 6E

STREAM STABILIZATION
Generalized Stability Analysis of Channel Banks,
W79-04574 8D

STREAMFLOW
Drainage Density and Streamflow: A Closer Look,
W79-04736 2E

Flood-Plain Delineation for Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch Basins, Fairfax County, Virginia,
W79-04801 2E

Disaggregation of Streamflow Volumes,
W79-04878 2E

STREAMS
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

Channelization and Invertebrate in Some Iowa Streams,
W79-04789 2E

A Computer Program for Simulating Salinity Loads in Streams,
W79-04800 5B

STRUCTURAL GEOLOGY
Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

SUBLETHAL EFFECTS
Chronic Exposure of Channel Catfish, Ictalurus Punctatus, to Ammonia: Effects on Growth and Survival,
W79-04835 5C

SUBSURFACE DRAINAGE
Toward More Detailed Field Monitoring of Variable Source Areas,
W79-04739 2G

Field Evaluations of Groundwater Control by Trench and Trenchless Methods of Installed Drains--Lower Rio Grande Valley of Texas,
W79-04906 4B

Subsurface Drainage Systems Installations in Arid Lands--The State of the Art,
W79-04907 5G

Trenchless Drainage,
W79-04912 8A

Interceptor Drains on Sloping Land,
W79-04916 4A

Prediction of Deflection for Corrugated Plastic Tubing,
W79-04983 8G

Subsurface Drain Spacing from Water Table and Outflow Measurements,
W79-04986 4B

SUBSURFACE DRAINS
Drainage Installation Equipments 'Economics of the Art',
W79-04910 5G

Failure Criteria for Corrugated-Plastic Drain Tubing,
W79-04979 8G

SUBSURFACE FLOW
The Computational Efficiency and Taylor Expansion Derivation of Approximating Equations to the Groundwater Flow Equation,
W79-04737 2F

Stochastic Analysis of Spatial Variability in Subsurface Flows 2. Evaluation and Application,
W79-04753 2F

Computer Model of Two-Dimensional Solute Transport and Dispersion in Ground Water,
W79-04813 6A

SUBSURFACE RUNOFF
Loss of High Flows by Seepage from Stream Channels in Kansas,
W79-04577 4A

SULFITE PULP MILLS
Advanced Steps Towards the Pollution-Free Bleached Sulfite Mill,
W79-04639 3C

SUMMER
Aspects of Water Column Primary Productivity in the Chukchi Sea During Summer,
W79-04765 5C

SUPERSATURATION
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

SURFACE-GROUNDWATER RELATIONSHIPS
Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

Predictive Analyses of Ground-Water Discharges in the Willow Creek Watershed, Northeast Nebraska,
W79-04805 6A

SURFACE IRRIGATION
Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

SURFACE RUNOFF
Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

SURFACE TENSION
The Mechanism of Mass Transfer Through a Liquid Interface,
W79-04666 3A

SURFACE WATER DECLINES
Water-Level Declines in the Madison Area, Dane County, Wisconsin,
W79-04809 7C

SURFACE WATERS
Water Resources Data for Colorado, Water Year 1977--Volume 1. Missouri River Basin, Arkansas River Basin, Rio Grande Basin.
W79-04790 7C

Water Resources Data for Colorado, Water Year 1977--Volume 2. Colorado River Basin Above Dolores River.
W79-04791 7C

Water Resources Data for Colorado, Water Year 1977--Volume 3. Dolores River Basin, Green River Basin, San Juan River Basin.
W79-04792 7C

Summary of Hydrologic Data Collected During 1976 in Dade County, Florida,
W79-04795 7C

Hydrologic Appraisal of the Water Resources of the Homer-Preble Valley, New York,
W79-04796 6D

Water-Quality Investigation of the Yellville Watershed, Arkansas,
W79-04802 7C

SURFACTANTS
Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

SURVEYS
Public Perceptions of Issues and Problems in the Lake Champlain Basin Area, A Summary,
W79-04558 2H

SURVIVAL
The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

SUSPENDED SOLIDS
Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

Long-Term Patterns of Sediment Production Following Road Construction and Logging in the Oregon Coast Range,
W79-04750 2J

SWAMPS
Notes on Freshwater Red Algae from West Malaysia,
W79-04768 5C

SWEDEN
Atmospheric Fallout and Street Cleaning-Effects on Urban Storm Water and Snow,
W79-04568 5B

SWITZERLAND
The Interrelationships Among Chemical Parameters in Rivers--Analysing the Effect of Natural and Anthropogenic Sources,
W79-04569 5B

SYNCHRONIZATION
Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

SYNTHETIC RUBBER
Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

SYSTEMATICS
Notes on Freshwater Red Algae from West Malaysia,
W79-04768 5C

SYSTEMS ANALYSIS
IIASA Conference' 76.
W79-04686 6A

Tisza and Vistula River Basins: Case Studies,
W79-04687 6A

TAILWATER
Sizing Tailwater Recovery Systems to Utilize Runoff from Precipitation on Irrigated Lands,
W79-04960 3F

TAITA EXPERIMENTAL BASIN (NEW ZEALAND)
Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

TANK CARS
Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

TANK TRUCKS
Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

TAYLOR COUNTY (TX)
Occurrence, Quantity, and Quality of Ground Water in Taylor County, Texas.
W79-04575 2F

TCHEFUNCTA RIVER (LA)
Flood Plain Information: Tchefuncta River and Tributaries, Covington, LA.
W79-04855 2E

TECHNOLOGY
IIASA Conference' 76.
W79-04686 6A

TEMORA STYLIFERA
Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

TEMORA TURBINATA
Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

TEMPERATURE GRADIENT
A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

TENNESSEE
Bulk Precipitation and Streamflow Quality Relationships in an Urban Area,
W79-04738 2E

TENSIOMETERS
Use of Methanol-Water Solutions for Freeze Protection of Tensiometers,
W79-04605 3F

TERRACING
Flat Channel Terraces for Pollution Abatement and Sediment Control,
W79-04914 4A

Parallel Terraces on Flat Slopes,
W79-04915 4A

Design and Operation of Gradient Terrace Systems,
W79-04918 2J

TERTIARY TREATMENT
Municipal Wastewater Aquaculture,
W79-04528 5D

Lake Nematode Population Increase Following Bypass of Secondary Effluent,
W79-04818 5C

TESTING PROCEDURES
A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

The Development of Standard Methods of Measuring Microbiological Production,
W79-04545 5C

Use of Biological Indicators for Monitoring Effect of Pollutants on the Marine Environment,
W79-04546 5C

Continuous Standard Water Delivery System for Bioassays with Aquatic Organisms,
W79-04770 5C

Recommended Procedures for the Testing and Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
W79-04944 3A

TEXAS
Problems of Public Access to Water in Texas Lakes and Streams: An Analysis,
W79-04555 6E

Occurrence, Quantity, and Quality of Ground Water in Taylor County, Texas.
W79-04575 2F

Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

Habitat Development Field Investigations, Bolivar Peninsula Marsh and Upland Habitat Development Site, Galveston Bay, Texas; Appendix D: Propagation of Vascular Plants and Post-Propagation Monitoring of Botanical, Soil, Aquatic Biota, and Wildlife Resources,
W79-04927 5E

THAILAND
Carbonate Chemistry of Groundwater from Tropical Tower Karst in South Thailand,
W79-04752 2F

THALLI
Morphological Variation and Life History in Cylindrical Forms of Scytosiphon Lomentaria (Scytosiphonaceae: Phaeophyta) from Southern Australia,
W79-04778 5C

THALWEG
Drainage Density and Streamflow: A Closer Look,
W79-04736 2E

THERMAL POLLUTION
Federal Water Pollution Control Act: The Sections 316 (A) and 316 (B) Process,
W79-04507 6E

Effect of Salt Upon Hot-Water Dispersion in Well-Mixed Estuaries,
W79-04729 2L

Three-Dimensional Temperature Model for Shallow Lakes,
W79-04731 5B

Temperature Influences on Growth of Aquatic Organisms,
W79-04851 5C

The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

THERMAL POWER
The Potential Impacts on Aquatic Ecosystems from the Release of Trace Elements in Geothermal Fluids,
W79-04881 5B

THERMAL WATER
An Evaluation of the Effects of Geothermal Energy Development on Aquatic Biota in the Geysers Area of California,
W79-04962 6G

THERMODYNAMICS
Thermodynamic Properties of Saline Water,
W79-04941 3A

THIN FILMS
Second Report on Fabrication and Evaluation of New Ultrathin Reverse Osmosis Membranes,
W79-04678 3A

TIDAL WATERS
Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

TILE DRAINAGE
Agricultural Drainage Problems in Kern County, California,
W79-04909 5G

TILLAGE PRACTICES
Corn Residue Management to Reduce Erosion in Irrigation Furrows,
W79-04724 4D

TIME-SERIES ANALYSIS
Enhancement of Water-Quality Monitoring Systems by Incorporating Water-Quality Modelling and Time-Series Analysis,
W79-04571 5B

TISSUE ANALYSIS
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

Contents of Total Mercury, Alkyl Mercury, and Methyl Mercury in Some Coastal Fish and Shells,
W79-04589 5A

Zinc Content of the Gills of Rainbow Trout (S. Gairdneri) after Treatment with Zinc Solutions under Normoxic and Hypoxic Conditions,
W79-04836 5C

Trace Metals in the Common Mussel, Mytilus Edulis (L.), and in the Alga Fucus Vesiculosus (L.) from the Region of the Sound (Oresund),
W79-04840 5B

Ambient Concentrations of PCBs in the Southeast from Storet Data and Selected EPA Studies,
W79-04848 5A

The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. I. Accumulation from Seawater and a Food Source,
W79-04968 5A

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. II. Preliminary Investigation of Cadmium-Binding Proteins,
W79-04969 5A

Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

Cadmium Turnover in the Shore Crab Carcinus Maenas,
W79-04973 5B

Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

Determination of Petroleum Hydrocarbons in Water, Fish and Sediments Following the Ekofisk Blow-Out,
W79-04976 5A

TISZA RIVER BASIN (HUNGARY)
Application of On-line Prediction Techniques to Forecasting Short Term Agricultural Water Demand,
W79-04689 6D

TOLUENE
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

TOXICITY
The Impact of Turpentine Recovery on the Toxicity and BOD of Kraft Mill Effluents,
W79-04534 5C

Impact of Metals on the Marine Environment,
W79-04552 5C

The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

Ammonia Toxicity and pH Control in Fish Toxicity Bioassays of Treated Wastewaters,
W79-04817 5C

Effects of Temperature and Salinity on the Life Cycle of Ophryotrocha Diadema (Polychaeta, Dorvilleidae),
W79-04823 5C

Paralytic Shellfish Toxins in the Sea Scallop, Placopecten Magellanicus, in the Bay of Fundy,
W79-04825 5A

Studies on Toxic Effects of Pesticides on Fish - II Toxic Effects of the Herbicide, Benthiocarb, on Carp. (In Japanese),
W79-04826 5C

Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

Acute Toxicity of Copper, Zinc and Manganese in Single and Mixed Salt Solutions to Juvenile Longfin Dace, Agosia Chrysogaster,
W79-04833 5C

The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

Zinc Content of the Gills of Rainbow Trout (S. Gairdneri) after Treatment with Zinc Solutions under Normoxic and Hypoxic Conditions,
W79-04836 5C

Toxic Effects of Zinc on Fathead Minnows Pimephales Promelas in Soft Water,
W79-04837 5C

The Hydrolysis of Ammonium Ions in Sea Water-Experimental Confirmation of Predicted Constants at One Atmosphere Pressure,
W79-04844 5A

Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

The Potential Impacts on Aquatic Ecosystems from the Release of Trace Elements in Geothermal Fluids,
W79-04881 5B

Effect of Copper on Volume Regulation in the Marine Flagellate Dunaliella Marina,
W79-04972 5C

TOXINS
Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

TRACE ELEMENTS
Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

The Potential Impacts on Aquatic Ecosystems from the Release of Trace Elements in Geothermal Fluids,
W79-04881 5B

Trace Elements in the Sediments of the Buffalo River, Arkansas,
W79-04956 5A

TRANSPIRATION
Photosynthesis, Transpiration, and Leaf Elongation in Corn Seedlings at Suboptimal Soil Temperatures,
W79-04608 2I

TRANSPORT DEPLETION
Reverse Osmosis Membrane Regeneration,
W79-04954 3A

TRANSPORTATION
Environmental Assessment of Coal Transportation,
W79-04531 5C

TRANSURANIC ELEMENTS
Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels
W79-04975 5A

TREATMENT
Reverse Osmosis Membrane Regeneration,
W79-04954 3A

TREATMENT FACILITIES
Estimating Costs for Water Treatment as a Function of Size and Treatment Plant Efficiency,
W79-04527 6E

The Application of Optimal Linear Regulator Theory to a Problem in Water Pollution,
W79-04596 7E

TURBIDITY
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

Optics of Turbid Estuarine Waters: Approximations and Applications,
W79-04734 1A

TURPENTINE
The Impact of Turpentine Recovery on the Toxicity and BOD of Kraft Mill Effluents,
W79-04534 5C

TWIN LAKES (OH)
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5G

UDOTEA PETIOLATA
Occurrence of Endophytic Bacteria in Siphonous Algae,
W79-04783 5C

TRAVIOLET RADIATION
JV-Induced Developmental Abnormalities in he Filamentous Blue-Green Alga Nostoc inckia,
V79-04779 5C

VA
Edible-Oil Pollution on Fanning Island,
V79-04841 5B

DERGROUND WASTE DISPOSAL
Geohydrology of the Northern Louisiana Salt-Dome Basin Pertinent to the Storage of Radioctive Wastes--A Progress Report,
V79-04810 5E

ITED STATES
First American-Soviet Symposium on the Biogical Effects of Pollution on Marine Organms.
V79-04537 5C

Report of the Joint American-Soviet Expedition n the Scientific Research Vessel 'Moscow Uniersity' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of quatic Ecosystems,
V79-04553 5C

SATURATED FLOW
Time-Dependent Solutions to the One-Dimenonal Linearized Moisture Flow Equation with Vater Extraction,
V79-04602 2G

Numerical Model for Saturated-Unsaturated low in Deformable Porous Media. 3. Applicaons,
V79-04749 2G

STEADY FLOW
Time-Dependent Solutions to the One-Dimenonal Linearized Moisture Flow Equation with Vater Extraction,
V79-04602 2G

PER WHITE RIVER BASIN (MO & AR)
lanning Status Report: Water Resource Apraisals for Hydroelectric Licensing--Upper Vhite River Basin, Missouri and Arkansas.
V79-04873 4A

BAN DRAINAGE
Methodology for Evaluation of Feasibility: Muljurisdictional Urban Drainage and Flood Conol Projects.
V79-04502 6F

BAN HYDROLOGY
lanning Storm-Drainage Systems for Urban rowth,
V79-04618 6F

BAN POLLUTION
imulation of Urban Non-Point Source Polluon,
V79-04609 5B

BAN RUNOFF
rban Runoff from a Road Surface--A Water uality Study,
V79-04567 5B

tmospheric Fallout and Street Cleaning-Efcts on Urban Storm Water and Snow,
V79-04568 5B

lanning Storm-Drainage Systems for Urban rowth,
V79-04618 6F

LUE
conomic Valuation of Shoreline,
V79-04620 6B

'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

A Methodology for Determining Land Value and Associated Benefits Created from Dredged Material Containment,
W79-04933 5E

VANADIUM
Effects of Heavy Metals Especially Selenium, Vanadium and Zirconium on Movement, Growth and Survival of Certain Animal Aquatic Life,
W79-04592 5C

VANCOUVER ISLAND
Transport of Nutrients and Carbon from the Nanaimo River to its Estuary,
W79-04726 2L

VAPOR COMPRESSION DISTILLATION
Economic Evaluation Study of Distillation of Saline Water by Means of Forced-Circulation Vapor-Compression Distillation Equipment,
W79-04939 3A

Research Continuation of Badger-Hickman Centrifugal Distillation Testing on Unit Number 4.
W79-04955 3A

VASCULAR PLANTS
Habitat Development Field Investigations, Bolivar Peninsula Marsh and Upland Habitat Development Site, Galveston Bay, Texas; Appendix D: Propagation of Vascular Plants and Post-Propagation Monitoring of Botanical, Soil, Aquatic Biota, and Wildlife Resources,
W79-04927 5E

VERTICAL MIGRATION
Vertical Migration of Benthos in Simulated Dredged Material Overburdens; Vol. I: Marine Benthos,
W79-04931 5E

VITAMIN K
Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

WAKEBY DISTRIBUTION
Birth of a Parent: The Wakeby Distribution for Modeling Flood Flows,
W79-04742 2E

WALNUT CREEK (CA)
Walnut Creek Channel Improvement Project, Contra Costa County, California; Hydraulic Model Investigation,
W79-04923 2E

WARREN COUNTY (IL)
Public Groundwater Supplies in Warren County,
W79-04720 7C

WASHINGTON
Interstorm Relations in Pacific Northwest,
W79-04733 2B

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

WASHITA RIVER (OK)
Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

WASTE DISPOSAL
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

Case Studies and Comparative Analyses of Issues Associated with Productive Land Use at Dredged Material Disposal Sites,
W79-04926 5E

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

WASTE DISPOSAL SITES
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

Vertical Migration of Benthos in Simulated Dredged Material Overburdens; Vol. I: Marine Benthos,
W79-04931 5E

A Methodology for Determining Land Value and Associated Benefits Created from Dredged Material Containment,
W79-04933 5E

Development of Procedures for Selecting and Designing Reusable Dredged Material Disposal Sites,
W79-04934 5E

WASTE IDENTIFICATION
A Colorimetric Analysis for Abietic-Type Resin Acids in Pulping Effluents,
W79-04636 5A

WASTE TREATMENT
Water Quality Planning in North Carolina,
W79-04922 6E

WASTE WATER DISPOSAL
Waste Injection into a Two-Phase Flow Field: Sand-Box and Hele-Shaw Models Study,
W79-04599 5E

WASTE WATER (POLLUTION)
Construction Costs for Municipal Wastewater Conveyance Systems: 1973-1977.
W79-04761 6B

WASTE WATER TREATMENT
Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

WASTE WATER TREATMENT

Municipal Wastewater Aquaculture,
W79-04528 5D

Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

Les Papeteries Du Bourray (France), an Example of Effective Treatment of Waste Waters (Les Papeteries du Bourray, un exemple d'epuration efficace des eaux residuaires).
W79-04561 5C

The Application of Optimal Linear Regulator Theory to a Problem in Water Pollution,
W79-04596 7B

Electrochemical Coagulation of Industrial Effluents (Elektrokhimicheskaya koagulyatsiya promyshlennykh stokov),
W79-04630 5D

Pilot-Plant Study of Two-Stage Chemical-Biological Purification of Pulping Effluents at the Ostroleka Pulp and Paper Mill (Badania poltechniczne nad oczyszczaniem sciekow celulozowych z Ostroleckich Zakladow Celulozowo-Papierniczych w Ukladzie Dwustopniowym Chemiczno-Biologicznym),
W79-04631 5D

Application of Reverse Osmosis and Ultrafiltration to Purification of Pulp and Paper Industry Effluents. VI. Purification of Pulp Bleaching Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego),
W79-04632 5D

Criteria for Selecting Installations for Fiber Recovery (Auswahlkriterien fuer Anlagen zur Faserrueckgewinnung),
W79-04633 5D

Removal of Color from Carbonate Pulping Effluent -- The Calcium-Magnesium Coagulation Process,
W79-04635 5D

Toxicity Removal by Primary Treatment (of Kraft Pulp Mill Effluent),
W79-04637 5D

Extracting Lignins from Mill Wastes,
W79-04640 5D

Reagent-Free Method of Effluent Neutralization (Bezreagentnyi sposob neitralizatsii stochnykh vod),
W79-04642 5D

Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

Predictive Model for Design of Fixed-Bed Adsorbers: Parameter Estimation and Model Development,
W79-04704 5D

Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

Energy for Production of Consumable Materials,
W79-04713 5D

Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

Purifying Oil Shale Retort Water,
W79-04883 5D

Sewage Treatment System,
W79-04886 5D

Apparatus for Treating Sewage,
W79-04888 5D

Process for Treating Caustic Wash Solutions,
W79-04889 5D

Process for the Purification of Greasy and Soiled Water Using a Heavy Solvent, and Apparatus for its Implementation,
W79-04890 5D

Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

Apparatus and Method for Treating Waste-Containing Liquors,
W79-04893 5D

Process and Apparatus for Removing Impurities Dissolved in Water,
W79-04894 5D

Ion Exchange Process,
W79-04895 5D

Flash Reactor,
W79-04896 5D

WASTES

Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

WASTEWATER TREATMENT

Coal Humic Substances for the Treatment of Wastewater from Stack Gas Scrubbers, Coal Conversion Plants, and Other Coal Utilization Facilities,
W79-04554 5D

Upgrading Faculative Wastewater Lagoons with Vascular Aquatic Plants,
W79-04830 5D

Fundamental Research Needs for Water and Wastewater Treatment Systems,
W79-04852 5D

WATER ALLOCATION (POLICY)

Water Utilization and Reallocation in Chile: A Study of the Pirque Valley,
W79-04695 6A

Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

WATER ANALYSIS

Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

Selected Water-Quality Data from the Merced River, California, November 1976 Through August 1977,
W79-04794 5B

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

WATER BANKING

Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

WATER CHEMISTRY

Sampling and Chemical Interpretation of Precipitation for Mass Balance Studies,
W79-04747 2B

Carbonate Chemistry of Groundwater from Tropical Tower Karst in South Thailand,
W79-04752 2F

WATER CONSERVATION

Water-Conservation Methods to Meet Pennsylvania's Water Needs,
W79-04598 3D

WATER CONSUMPTION

Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

WATER CONVERSION

Final Three Years' Progress on Study and Field Evaluation of Sea Water Stills.
W79-04512 3A

Research on Methods for Solar Distillation,
W79-04513 3A

Second Two Years' Progress on Study and Field Evaluation of Solar Sea-Water Stills.
W79-04514 3A

WATER DELIVERY

Continuous Standard Water Delivery System for Bioassays with Aquatic Organisms,
W79-04770 5C

WATER DEMAND

Application of On-line Prediction Techniques to Forecasting Short Term Agricultural Water Demand,
W79-04689 6D

Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas,
W79-04867 6B

WATER LAW

Institutional Arrangements for Effective Water Management in Colorado,
W79-04503 6E

Problems of Public Access to Water in Texas Lakes and Streams: An Analysis,
W79-04555 6E

Water Law - Rights of Importers and Developers of Water. City and County of Denver v. Fulton Irrigating Ditch Co., 506 P.2d 144 (Colo. 1972),
W79-04594 6E

An Analysis of Playa Lake Water Utilization on the Texas High Plains,
W79-04611 6E

Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

Analysis of Alaska's Water Use Act and Its Interaction with Federal Reserved Water Rights,
W79-04959 6E

WATER LEVELS
Water-Level Declines in the Madison Area, Dane County, Wisconsin,
W79-04809 7C

WATER LOSS
Loss of High Flows by Seepage from Stream Channels in Kansas,
W79-04577 4A

WATER MANAGEMENT
Managing the Low-Yield Water Well,
W79-04580 4B

WATER MANAGEMENT (ADMINISTRATIVE)
Water Management Policies and Instrument.
W79-04856 5G

WATER MANAGEMENT (APPLIED)
Tisza and Vistula River Basins: Case Studies,
W79-04687 6A

Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

Institutional Concerns: The Delaware Experience,
W79-04804 4A

WATER MANAGEMENT INSTRUMENTS
Water Management Policies and Instrument.
W79-04856 5G

WATER PERMITS
Analysis of Alaska's Water Use Act and Its Interaction with Federal Reserved Water Rights,
W79-04959 6E

WATER POLICY
Speculative Policy Making in the Environmental Arena,
W79-04613 6E

Water Management Policies and Instrument.
W79-04856 5G

Water Policy and Decision-Making in the Colorado River Basin,
W79-04868 6E

Water Quality Planning in North Carolina,
W79-04922 6E

Analysis of Alaska's Water Use Act and Its Interaction with Federal Reserved Water Rights,
W79-04959 6E

Summary Report of Phase II. Development of Techniques for Estimating the Potentials of Water Resources Development in Achieving National and Regional Social Goals.
W79-04965 6B

WATER POLLUTION
Distribution of Stable Organic Molecules in the Marine Environment: Physical Chemical Aspects. Chlorinated Hydrocarbons,
W79-04559 5C

Volatile Liquid Hydrocarbons in the Surface Coastal Waters of the Gulf of Mexico,
W79-04560 5C

Determining Nutrient Loading from Rainfall and Runoff in Small Rivers,
W79-04566 5B

Inactivation of Polioviruses and Coxsackieviruses in Surface Water,
W79-04591 5B

Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

Selected Water-Quality Data from the Merced River, California, November 1976 Through August 1977,
W79-04794 5B

Fundamental Research Needs for Water and Wastewater Treatment Systems,
W79-04852 5D

Method for Detecting Water Pollutants,
W79-04897 5A

WATER POLLUTION CONTROL
Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

Advanced Steps Towards the Pollution-Free Bleached Sulfite Mill,
W79-04639 3C

A Model for Determining the Impact of Control Costs on Municipal Finances,
W79-04698 6C

Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

Improvements Needed in the Corps of Engineers' Regulatory Program for Protecting the Nation's Waters.
W79-04871 6B

Sewage Treatment System,
W79-04886 5D

Process for Treating Caustic Wash Solutions,
W79-04889 5D

Flotation Means for Barrier for Water Carried Pollutants and Method of Making Same,
W79-04891 5G

WATER POLLUTION EFFECT
Research on Pulp and Paper Industry Water and Effluent Quality Problems -- A Review,
W79-04668 5C

WATER POLLUTION EFFECTS
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

First American-Soviet Symposium on the Biological Effects of Pollution on Marine Organisms.
W79-04537 5C

Design of Simulation Models to Determine Biological Impact of Pollutants on the Marine Environment,
W79-04538 5C

Impact of Radioactivity on the Marine Environment,
W79-04542 5C

The Effect of Radioactive Pollution of Reservoirs on Fish,
W79-04543 5C

Use of Biological Indicators for Monitoring Effect of Pollutants on the Marine Environment,
W79-04546 5C

Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

Persistence Limits in Ecological Systems,
W79-04548 5C

The Development of Standard Laboratory and Field Ecosystem Research to Determine the Effects of Pollutants on the Marine Environment,
W79-04549 5C

Impact of Pesticides on the Marine Environment,
W79-04550 5C

Oil and Marine Organisms,
W79-04551 5C

Impact of Metals on the Marine Environment,
W79-04552 5C

Added Chlorine in Aquatic Environments,
W79-04899 5C

Flare Up Over North Sea Birds,
W79-04900 5C

A Simple Method for Screening Petroleum Effluents by In Vitro Enzyme Inhibition,
W79-04902 5C

WATER POLLUTION SOURCES
Oil Shale and the Environment,
W79-04522 6B

Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

Environmental Assessment of Coal Transportation,
W79-04531 5C

Urban Runoff from a Road Surface--A Water Quality Study,
W79-04567 5B

Atmospheric Fallout and Street Cleaning-Effects on Urban Storm Water and Snow,
W79-04568 5B

The Interrelationships Among Chemical Parameters in Rivers--Analysing the Effect of Natural and Anthropogenic Sources,
W79-04569 5B

Phosphorus Loadings to Lakes and Some of Their Responses. Part 1. A New Calculation of Phosphorus Loading and Its Application to 13 New York Lakes,
W79-04621 5B

Factors Affecting the Export of Nitrate-Nitrogen from Drainage Basins in Southern Ontario,
W79-04735 5B

Pollution of a Water Supply Catchment by Breeding Gulls and the Potential Environmental Health Implications,
W79-04843 5B

Method for Detecting Water Pollutants,
W79-04897 5A

WATER POLLUTION TREATMENT
Ultrasonic Oil Spill Removal,
W79-04882 5G

Purifying Oil Shale Retort Water,
W79-04883 5D

Apparatus for Treating Sewage,
W79-04888 5D

WATER POLLUTION TREATMENT

Process for the Purification of Greasy and Soiled Water Using a Heavy Solvent, and Apparatus for its Implementation,
W79-04890 5D

Apparatus and Method for Treating Waste-Containing Liquors,
W79-04893 5D

Process and Apparatus for Removing Impurities Dissolved in Water,
W79-04894 5D

Ion Exchange Process,
W79-04895 5D

WATER PROPERTIES

Optics of Turbid Estuarine Waters: Approximations and Applications,
W79-04734 1A

Behavior of Water in Various States,
W79-04951 1A

WATER PURIFICATION

Continuous Standard Water Delivery System for Bioassays with Aquatic Organisms,
W79-04770 5C

Water Purification by Reverse Osmosis,
W79-04887 3A

Process and Apparatus for Removing Impurities Dissolved in Water,
W79-04894 5D

WATER QUALITY

Limnological Aspects of Lake Mead, Nevada-Arizona,
W79-04506 2H

Urban Runoff from a Road Surface--A Water Quality Study,
W79-04567 5B

Enhancement of Water-Quality Monitoring Systems by Incorporating Water-Quality Modelling and Time-Series Analysis,
W79-04571 5B

Occurrence, Quantity, and Quality of Ground Water in Taylor County, Texas.
W79-04575 2F

Verification of an Estuarine Model for Apalachicola Bay, Florida,
W79-04582 2L

Research on Pulp and Paper Industry Water and Effluent Quality Problems -- A Review,
W79-04668 5C

Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

Laboratory Studies of Gas Tracers for Reaeration,
W79-04712 5A

Quality Considerations for Water Supply Evaluations,
W79-04714 6B

A Mathematical Deterministic River-Quality Model. Part I: Formulation and Description,
W79-04721 5B

A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

Factors Affecting the Export of Nitrate-Nitrogen from Drainage Basins in Southern Ontario,
W79-04735 5B

Bulk Precipitation and Streamflow Quality Relationships in an Urban Area,
W79-04738 2E

Water Resources Data for Colorado, Water Year 1977--Volume 1. Missouri River Basin, Arkansas River Basin, Rio Grande Basin.
W79-04790 7C

Water Resources Data for Colorado, Water Year 1977--Volume 2. Colorado River Basin Above Dolores River.
W79-04791 7C

Water Resources Data for Colorado, Water Year 1977--Volume 3. Dolores River Basin, Green River Basin, San Juan River Basin.
W79-04792 7C

Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

Selected Water-Quality Data from the Merced River, California, November 1976 Through August 1977,
W79-04794 5B

Summary of Hydrologic Data Collected During 1976 in Dade County, Florida,
W79-04795 7C

Hydrologic Appraisal of the Water Resources of the Homer-Preble Valley, New York,
W79-04796 6D

Water-Quality Investigation of the Yellville Watershed, Arkansas,
W79-04802 7C

Postimpoundment Survey of Water-Quality Characteristics of Raystown Lake, Huntington and Bedford Counties, Pennsylvania,
W79-04806 2H

Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

Water-Oriented Outdoor Recreation in the Illinois River Basin (Appendix VI)--Illinois-Indiana-Wisconsin.
W79-04853 6B

Stony Brook Harbor: An Interdisciplinary Analysis,
W79-04862 6B

A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

Water Policy and Decision-Making in the Colorado River Basin,
W79-04868 6E

Improvements Needed in the Corps of Engineers' Regulatory Program for Protecting the Nation's Waters.
W79-04871 6B

Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

WATER QUALITY CONTROL

A Pilot Plant Study to Provide Improved Quality Feed Water for the Webster, South Dakota Electrodialysis Plant,
W79-04510 5F

Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

Simulation of Urban Non-Point Source Pollution,
W79-04609 5B

Benefits and Costs of Water Quality Improvements,
W79-04699 6B

Purifying Oil Shale Retort Water,
W79-04883 5D

Flotation Means for Barrier for Water Carried Pollutants and Method of Making Same,
W79-04891 5G

Flash Reactor,
W79-04896 5D

Water Quality Planning in North Carolina,
W79-04922 6E

WATER QUALITY CRITERIA

A Geographically Variable Water Quality Index Used in Oregon,
W79-04697 5A

WATER QUALITY INDEX

The Development of a Combined Water Quality Index,
W79-04610 6B

A Geographically Variable Water Quality Index Used in Oregon,
W79-04697 5A

WATER QUALITY PLANNING

Water Quality Planning in North Carolina,
W79-04922 6E

WATER QUALITY STANDARDS

Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

Water Quality Planning in North Carolina,
W79-04922 6E

WATER QUANTITY

Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

WATER QUANTITY MANAGEMENT

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Lower White River Basin, Missouri-Arkansas.
W79-04872 4A

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Upper White River Basin, Missouri and Arkansas.
W79-04873 4A

WATER RESO

Water in Land Use Planning.
W79-04681 6A

WATER RESOURCES

IIASA Conference' 76.
W79-04686 6A

Tisza and Vistula River Basins: Case Studies,
W79-04687 6A

Applying Multiattribute Utility Theory to Evaluation of Tisza River Basin Development Plans,
W79-04688 6A

Comparison of Alternative Engineering Designs,
W79-04690 6A

A Viable Methodology to Implement the Principles and Standards,
W79-04692 6A

Allocation Procedure of Water and Land Resources in Relation to Some Irrigation Quality Parameters,
W79-04700 6A

Economic Performance of Reservoirs a Sensitivity Analysis,
W79-04711 6B

Pennsylvania Annual Progress Report, 1978,
W79-04797 7C

A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

Water Policy and Decision-Making in the Colorado River Basin,
W79-04868 6E

WATER RESOURCES DEVELOPMENT
Water-Oriented Outdoor Recreation in the Illinois River Basin (Appendix VI)--Illinois-Indiana-Wisconsin.
W79-04853 6B

A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Upper White River Basin, Missouri and Arkansas.
W79-04873 4A

Water Quality Planning in North Carolina,
W79-04922 6E

WATER RESOURCES MANAGEMENT
Water Management Policies and Instrument.
W79-04856 5G

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Lower White River Basin, Missouri-Arkansas.
W79-04872 4A

WATER RESOURCES PLANNING
Improvements Needed in the Corps of Engineers' Regulatory Program for Protecting the Nation's Waters.
W79-04871 6B

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Lower White River Basin, Missouri-Arkansas.
W79-04872 4A

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Upper White River Basin, Missouri and Arkansas.
W79-04873 4A

Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

WATER REUSE
Municipal Wastewater Aquaculture,
W79-04528 5D

Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

Process for Treating Caustic Wash Solutions,
W79-04889 5D

WATER RIGHTS
Water Law - Rights of Importers and Developers of Water. City and County of Denver v. Fulton Irrigating Ditch Co., 506 P.2d 144 (Colo. 1972),
W79-04594 6E

Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

Analysis of Alaska's Water Use Act and Its Interaction with Federal Reserved Water Rights,
W79-04959 6E

WATER SHORTAGE
Economic Issues Related to Large-Scale Water Transfers in the USA,
W79-04759 6D

WATER SOFTENING
Treatment of Water,
W79-04885 5F

WATER SOURCES
Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

WATER SUPLY
Hydrologic Appraisal of the Water Resources of the Homer-Preble Valley, New York,
W79-04796 6D

WATER SUPPLIES
Nitrates in Water Supply Abstractions in the Anglian Region: Current Trends and Remedies under Investigation,
W79-04570 5A

WATER SUPPLY
Hard-Rock Wells get Mariposa Through the Drought,
W79-04579 3B

Managing the Low-Yield Water Well,
W79-04580 4B

Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

Quality Considerations for Water Supply Evaluations,
W79-04714 6B

Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

Public Groundwater Supplies in Warren County,
W79-04720 7C

Social and Economic Aspects of Water Exploitation,
W79-04760 6B

Water Policy and Decision-Making in the Colorado River Basin,
W79-04868 6E

WATER SUPPLY DEVELOPMENT
A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

WATER TABLE AQUIFERS
The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

WATER TEMPERATURE
Inactivation of Polioviruses and Coxsackieviruses in Surface Water,
W79-04591 5B

Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

Three-Dimensional Temperature Model for Shallow Lakes,
W79-04731 5B

Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

Effects of Temperature and Salinity on the Life Cycle of Ophryotrocha Diadema (Polychaeta, Dorvilleidae),
W79-04823 5C

The Influence of Temperature and Wet Weight on the Oxygen Demand of Rainbow Trout (Salmo Gairdneri R.) in Fresh Water,
W79-04832 5C

The Effects of Heated Effluents on the Production of Marine Plankton (Takahama Nuclear Power Station-I) (In Japanese),
W79-04842 5B

A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

Temperature Influences on Growth of Aquatic Organisms,
W79-04851 5C

WATER TRANSFER
Economic Issues Related to Large-Scale Water Transfers in the USA,
W79-04759 6D

WATER TREATMENT
Ion-Exchange Pretreatment of Water After Resin Regeneration with Reverse Osmosis Reject Brine,
W79-04505 5F

A Pilot Plant Study to Provide Improved Quality Feed Water for the Webster, South Dakota Electrodialysis Plant,
W79-04510 5F

Estimating Costs for Water Treatment as a Function of Size and Treatment Plant Efficiency,
W79-04527 6B

Energy for Production of Consumable Materials,
W79-04713 5D

Solution of Granular Bed Filtration Equations,
W79-04716 5F

Process for the Sequestration of Oxygen Dissolved in Water and Compositions Useful for Such Purpose,
W79-04884 5F

Treatment of Water,
W79-04885 5F

Water Purification by Reverse Osmosis,
W79-04887 3A

WATER USE
Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

WATER USERS
Recreational Boating on the Tidal Waters of Maryland. A Management Study.
W79-04876 6B

WATER UTILIZATION
Water-Conservation Methods to Meet Pennsylvania's Water Needs,
W79-04598 3D

An Analysis of Playa Lake Water Utilization on the Texas High Plains,
W79-04611 6E

Water Utilization and Reallocation in Chile: A Study of the Pirque Valley,
W79-04695 6A

WATER WELLS
Hard-Rock Wells get Mariposa Through the Drought,
W79-04579 3B

Managing the Low-Yield Water Well,
W79-04580 4B

Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

WATER YIELD
Managing the Low-Yield Water Well,
W79-04580 4B

Delayed Aquifer Yield as a Phenomenon of Delayed Air Entry,
W79-04744 2G

WATERSHEDS (BASINS)
Factors Affecting the Export of Nitrate-Nitrogen from Drainage Basins in Southern Ontario,
W79-04735 5B

Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

Pollution of a Water Supply Catchment by Breeding Gulls and the Potential Environmental Health Implications,
W79-04843 5B

WAVE HEIGHT
Irregular Wave Runup and Overtopping,
W79-04814 2H

WAVE PILE-UP
Irregular Wave Runup and Overtopping,
W79-04814 2H

WEATHER DATA
Is the Soil Frozen or Not. An Algorithm Using Weather Records,
W79-04740 2G

WEIRS
Uniformly Discharging Lateral Weirs,
W79-04573 8B

WELD COUNTY (CO)
Flood Plain Information: Big Thompson River, Weld County, Colorado,
W79-04854 2E

WELFARE (ECONOMICS)
Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

WELL DATA
Public Groundwater Supplies in Warren County,
W79-04720 7C

WETLAND
The Relationship Between Aboveground and Belowground Biomass of Freshwater Tidal Wetland Macrophytes,
W79-04627 2I

WETLANDS
Improvements Needed in the Corps of Engineers' Regulatory Program for Protecting the Nation's Waters.
W79-04871 6B

WHEELER RESERVOIR (AL)
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

WHITE CLAY CREEK (PA)
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

WHITE RIVER BASIN (MO & AR)
Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Lower White River Basin, Missouri-Arkansas.
W79-04872 4A

Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Upper White River Basin, Missouri and Arkansas.
W79-04873 4A

WILDLIFE
Effects of Geothermal Energy Development of Fish and Wildlife,
W79-04508 5C

A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

Habitat Development Field Investigations, Bolivar Peninsula Marsh and Upland Habitat Development Site, Galveston Bay, Texas; Appendix D: Propagation of Vascular Plants and Post-Propagation Monitoring of Botanical, Soil, Aquatic Biota, and Wildlife Resources,
W79-04927 5E

WILLAMETTE RIVER BASIN (OR)
Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

WILLOW CREEK WATERSHED
Predictive Analyses of Ground-Water Discharges in the Willow Creek Watershed, Northeast Nebraska,
W79-04805 6A

WINDS
Water Absorption by Plants in a Dry Wind and Under Periodic Spraying with Water (In Russian),
W79-04707 3F

WINTER
Winter Storms and the Record-Breaking Winter in Illinois,
W79-04839 2B

WINTER STORMS
Winter Storms and the Record-Breaking Winter in Illinois,
W79-04839 2B

WISCONSIN
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

Flood Hazard Study: Bark River, Village of Dousman and Vicinity, Waukesha County, Wisconsin.
W79-04863 2E

YAMPA RIVER BASIN
Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development,
W79-04808 6A

YAZOO HEADWATER PROJECT
Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

YELLVILLE WATERSHED
Water-Quality Investigation of the Yellville Watershed, Arkansas,
W79-04802 7C

YOKELY BAYOU (LA)
Special Flood Hazard Information: Franklin, Louisiana and Vicinity, Yokely Bayou and Bayou Teche.
W79-04864 2E

YOSEMITE NATIONAL PARK
Selected Water-Quality Data from the Merced River, California, November 1976 Through August 1977,
W79-04794 5B

ZINC
Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

Acute Toxicity of Copper, Zinc and Manganese in Single and Mixed Salt Solutions to Juvenile Longfin Dace, Agosia Chrysogaster,
W79-04833 5C

The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

Zinc Content of the Gills of Rainbow Trout (S. Gairdneri) after Treatment with Zinc Solutions under Normoxic and Hypoxic Conditions,
W79-04836 5C

Toxic Effects of Zinc on Fathead Minnows Pimephales Promelas in Soft Water,
W79-04837 5C

Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

ZIRCONIUM
Effects of Heavy Metals Especially Selenium, Vanadium and Zirconium on Movement, Growth and Survival of Certain Animal Aquatic Life,
W79-04592 5C

ZONE FREEZING
The Zone-Purification Process as a Method of Preparation of Potable Water from Sea Water,
W79-04936 3A

ZONING
Flood Plain Information: Salt Creek - Vicinity of Pueblo, Colorado.
W79-04865 2E

ZOOPLANKTON
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

The Effects of Heated Effluents on the Production of Marine Plankton (Takahama Nuclear Power Station-I) (In Japanese),
W79-04842 5B

AUTHOR INDEX

AARSTAD, J. S.
Corn Residue Management to Reduce Erosion in Irrigation Furrows,
W79-04724 4D

ABBOTT, I. A.
New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

ADIN, A.
Solution of Granular Bed Filtration Equations,
W79-04716 5F

AHRENS, J. P.
Irregular Wave Runup and Overtopping,
W79-04814 2H

AKAZAVA, T.
Pathway and Products of CO2-Fixation by Green Prokaryotic Algae in the Cloacal Cavity of Diplosoma Virens,
W79-04787 5C

AKESSON, B.
Effects of Temperature and Salinity on the Life Cycle of Ophryotrocha Diadema (Polychaeta, Dorvilleidae),
W79-04823 5C

ALBAUGH, E. W.
Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

ALBERS, P. H.
No. 2 Fuel Oil Decreases Embryonic Survival of Great Black-Backed Gulls,
W79-04628 5C

ALLEN, L. H. JR.
Measurement of Evaporation from Lakes and Ponds in Florida,
W79-04583 2D

ALLES, H.
Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

AMUNDSEN, C. C.
Characterization of the Growth of Myriophyllum spicatum and Its Influence in the Aquatic Ecosystems of the Tennessee Valley,
W79-04625 4A

ANDERSON, M. G.
Toward More Detailed Field Monitoring of Variable Source Areas,
W79-04739 2G

ANGELIDES, S.
Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

ANISIMOVA, M. I.
Electrochemical Coagulation of Industrial Effluents (Elektrokhimicheskaya koagulyatsiya promyshlennykh stokov),
W79-04630 5D

ANRAKU, M.
The Effects of Heated Effluents on the Production of Marine Plankton (Takahama Nuclear Power Station-I) (In Japanese),
W79-04842 5B

APOLINARSKI, M.
Pilot-Plant Study of Two-Stage Chemical-Biological Purification of Pulping Effluents at the Ostroleka Pulp and Paper Mill (Badania poltechniczne nad oczyszczaniem sciekow celulozowych z Ostroleckich Zakladow Celulozowo-Papierniczych w Ukladzie Dwustopniowym Chemiczno-Biologicznym),
W79-04631 5D

APPELQUIST, H.
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

APPLEMAN, R. A.
Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

ARCHER, E.
Parallel Terraces on Flat Slopes,
W79-04915 4A

ARGHIROPOULOS, B.
Process for the Sequestration of Oxygen Dissolved in Water and Compositions Useful for Such Purpose,
W79-04884 5F

ARMANT, D. R.
A Simple Method for Screening Petroleum Effluents by In Vitro Enzyme Inhibition,
W79-04902 5C

ARMITAGE, B. J.
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

ARMSTRONG, C. L.
Failure Criteria for Corrugated-Plastic Drain Tubing,
W79-04979 8G

ASGIAN, M. I.
A New Function for Use in the Hodograph Method,
W79-04748 2F

ATKINSON, L. P.
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

BABCHUK, M. I.
Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

BABKIN, V. A.
Electrochemical Coagulation of Industrial Effluents (Elektrokhimicheskaya koagulyatsiya promyshlennykh stokov),
W79-04630 5D

BACHMANN, R. W.
Channelization and Invertebrate in Some Iowa Streams,
W79-04789 2E

BAENSCH, U.
Process and Apparatus for Removing Impurities Dissolved in Water,
W79-04894 5D

BAILEY, G. W.
Predicting and Simulating Pesticide Transport from Agricultural Land: Mathematical Model Development and Testing,
W79-04920 5B

BAIRD, R.
Ammonia Toxicity and pH Control in Fish Toxicity Bioassays of Treated Wastewaters,
W79-04817 5C

BAKAEVA, E. M.
Dynamics of Effluent Clarification (Dinamika osvetleniya stochnykhvod),
W79-04645 5D

BAKER, J. R.
Limnological Aspects of Lake Mead, Nevada-Arizona,
W79-04506 2H

BAKR, A. A.
Stochastic Analysis of Spatial Variability in Subsurface Flows 2. Evaluation and Application,
W79-04753 2F

BALANI, M. C.
Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

BARDACH, E.
Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

BARKER, J.
The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

BARKO, J. W.
The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

BARLOW, E. W. R.
Photosynthesis, Transpiration, and Leaf Elongation in Corn Seedlings at Suboptimal Soil Temperatures,
W79-04608 2I

BARNEY, K. P. JR.
Quality Considerations for Water Supply Evaluations,
W79-04714 6B

BARTHOLIC, J. F.
Measurement of Evaporation from Lakes and Ponds in Florida,
W79-04583 2D

BAUGHMAN, G. L.
Transformation and Transport Processes in Aquatic Systems,
W79-04656 5B

BAUMGARTNER, D. J.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

BECK, L. A.
Financing Regional Drainage Facilities Under 1978 Economic Conditions,
W79-04911 5G

BELL, A. E.
Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

BELL, G. R.
A Pilot Plant Study to Provide Improved Quality Feed Water for the Webster, South Dakota Electrodialysis Plant,
W79-04510 5F

BENEDETTO-CASTRO, L.
Process and Apparatus for Removing Impurities Dissolved in Water,
W79-04894 5D

BENOIT, D. A.
Toxic Effects of Zinc on Fathead Minnows Pimephales Promelas in Soft Water,
W79-04837 5C

BERDYSHEV, A. G.
Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

BERG, D.
Reverse Osmosis Membranes Containing Graphitic Oxide,
W79-04665 3A

BERGER, C.
Investigation of Inorganic Ion Exchange Membranes for Electrodialysis Application,
W79-04942 3A

BERGKVIST, S.
Advanced Steps Towards the Pollution-Free Bleached Sulfite Mill,
W79-04639 3C

BERNSTEIN, A. D.
Methodology for Designing Cost-Effective Monitoring and Compliance Strategies for Pesticide Use,
W79-04524 6A

BEROV, M. B.
Mechanism of Aluminum Sulfate Recovery from Lignin Sludge (Mekhanism izvlecheniya sulfat alyuminiya iz shlam-lignina),
W79-04643 5D

BESCHTA, R. L.
Long-Term Patterns of Sediment Production Following Road Construction and Logging in the Oregon Coast Range,
W79-04750 2J

BETSON, R. P.
Bulk Precipitation and Streamflow Quality Relationships in an Urban Area,
W79-04738 2E

BEVIER, B. R.
Prediction of Deflection for Corrugated Plastic Tubing,
W79-04983 8G

BHUIYAN, S. I.
Quantification of Rice Yield Benefits Attributable to Irrigation Water,
W79-04999 3F

BIANCHIN, B.
Papermaking Primary Sludges. Dewatering Studies Realized with Different Industrial Devices (Boues primaires de papeterie. Essais de deshydratation realises avec differents appareils industriels),
W79-04581 5D

BILL, R. G. JR.
Measurement of Evaporation from Lakes and Ponds in Florida,
W79-04583 2D

BLACKWOOD, T. R.
Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

BLANTON, J. O.
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

BOBOVNIKOVA, TS. I.
Estimation of Organochlorine Pesticide Loss in Surface Runoff Waters,
W79-04655 5B

BOCHKAREV, G. R.
Electrochemical Coagulation of Industrial Effluents (Elektrokhimicheskaya koagulyatsiya promyshlennykh stokov),
W79-04630 5D

BODZEK, M.
Application of Reverse Osmosis and Ultrafiltration to Purification of Pulp and Paper Industry Effluents. VI. Purification of Pulp Bleaching Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego),
W79-04632 5D

BOERSMA, L.
Photosynthesis, Transpiration, and Leaf Elongation in Corn Seedlings at Suboptimal Soil Temperatures,
W79-04608 2I

BOGARDI, I.
Input for a Stochastic Control Model of P Loading,
W79-04623 5B

BOND, M. T.
Chemical Precipitation-Coagulation for Organic Color Removal from Groundwaters,
W79-04614 5F

BONDURANT, D. T.
Design and Operation of Gradient Terrace Systems,
W79-04918 2J

BONNICKSEN, T. M.
A Policy-Oriented Simulation Model of Debris Production from a Chaparral-Covered Watershed,
W79-04967 6A

BOREMAN, J.
Factors Affecting Accuracy of Ichthyoplankton Samples Used in Power Plant Entrainment Studies,
W79-04504 5C

BOSTER, M. A.
Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

BOTT, T. L.
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

BOTTOMLEY, J.
Ammonia Toxicity and pH Control in Fish Toxicity Bioassays of Treated Wastewaters,
W79-04817 5C

BOUWER, H.
Delayed Aquifer Yield as a Phenomenon of Delayed Air Entry,
W79-04744 2G

BOVEE, E. C.
Effects of Heavy Metals Especially Selenium, Vanadium and Zirconium on Movement, Growth and Survival of Certain Animal Aquatic Life,
W79-04592 5C

BOWIE, J. E. JR.
Chemical Precipitation-Coagulation for Organic Color Removal from Groundwaters,
W79-04614 5F

BOWLES, R. R.
Factors Affecting Accuracy of Ichthyoplankton Samples Used in Power Plant Entrainment Studies,
W79-04504 5C

BOYD, C. E.
Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

BOYD, S.
Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

BOYER, J. S.
Dry Matter Production and Translocation in Maize Subjected to Drought During Grain Fill,
W79-04606 2I

BRAGA, Y. Y.
Seasonal Growth and Succession of Tropical and Introduced Phytoplankton Cultured in Deep Sea Water,
W79-04772 5C

BRAZHNIKOVA, L. V.
Hexachlorocyclohexane, Metaphos, and Chlorophos Decomposition in Soil and Their Migration with the Waters of Surface Runoff,
W79-04654 5B

BREDEHOEFT, J. D.
Computer Model of Two-Dimensional Solute Transport and Dispersion in Ground Water,
W79-04813 6A

BREHANY, J. J.
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

BRENDECKE, C. M.
Environmental Considerations in Three Infrastructure Planning Agencies: An Overview of Research Findings,
W79-04680 6E

BRENKERT, A. L.
Characterization of the Growth of Myriophyllum spicatum and Its Influence in the Aquatic Ecosystems of the Tennessee Valley,
W79-04625 4A

BRETON, E. J. JR.
Water and Ion Flow Through Imperfect Osmotic Membranes,
W79-04937 3A

BREWER, C. C.
Cadmium Turnover in the Shore Crab Carcinus Maenas,
W79-04973 5B

BREZONIK, P. L.
Sources, Levels, and Reactions of Boron in Florida Waters,
W79-04603 2K

BRIAN, P. L. T.
Washing of Brine from Ice Crystals,
W79-04674 3A

BRICE, D. B.
Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

BROCK, J. T.
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

BROCKSEN, R. W.
The Potential Impacts on Aquatic Ecosystems from the Release of Trace Elements in Geothermal Fluids,
W79-04881 5B

BROSSMAN, J. J.
Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

BROWN, G. M. JR.
Economic Valuation of Shoreline,
W79-04620 6B

BROWN, R. M.
The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

BRUGGEMANN, M.
Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

BRUNER, R. J.
Ambient Concentrations of PCBs in the Southeast from Storet Data and Selected EPA Studies,
W79-04848 5A

BRUTSAERT, W.
A Nonlinear Analysis of the Relationship Between Rainfall and Runoff for Extreme Floods,
W79-04604 2A

BRUTSAERT, W. F.
Radon in Potable Water Supplies in Maine,
W79-04593 5B

BRYUKVIN, V. G.
Water Absorption by Plants in a Dry Wind and Under Periodic Spraying with Water (In Russian),
W79-04707 3F

BUCHANAN, A. S.
Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

BUCHTA, H. G.
Flat Channel Terraces for Pollution Abatement and Sediment Control,
W79-04914 4A

BUCKS, D. A.
Assessing Trickle Emitter Application Uniformity,
W79-04990 3F

BUIKEMA, A. L. JR.
A Simple Method for Screening Petroleum Effluents by In Vitro Enzyme Inhibition,
W79-04902 5C

BULLER, W.
Hydrologic Appraisal of the Water Resources of the Homer-Preble Valley, New York,
W79-04796 6D

BURDIN, K. C.
Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

BURDIN, K. S.
The Development of Standard Laboratory and Field Ecosystem Research to Determine the Effects of Pollutants on the Marine Environment,
W79-04549 5C

BURGES, S.
Disaggregation of Streamflow Volumes,
W79-04878 2E

BURKE, T. A.
Limnological Aspects of Lake Mead, Nevada-Arizona,
W79-04506 2H

BURMEISTER, L. C.
Improvement of the Steady Floating Random Walk Monte Carlo Method Near Straight Line and Circular Boundaries with Application to Groundwater Flow,
W79-04557 2F

BURNETT, F. C.
A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

BURT, T. P.
Toward More Detailed Field Monitoring of Variable Source Areas,
W79-04739 2G

BUSBY, J. F.
Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

BYKOVA, S. S.
Dewatering of High-Ash Sediments of Effluents (Obezvozhivamie vysokozolinykh osadkov stochnykh vod),
W79-04644 5D

BYRD, J. E.
The Effect of Recreation on Water Quality,
W79-04963 5B

CADOTTE, J. E.
Second Report on Fabrication and Evaluation of New Ultrathin Reverse Osmosis Membranes,
W79-04678 3A

CAIRNS, J. JR.
A Computer Monitored Aquatic Bioassay System,
W79-04652 5A

Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

A Simple Method for Screening Petroleum Effluents by In Vitro Enzyme Inhibition,
W79-04902 5C

CALABRESE, G.
Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

CALDER, I. R.
A Note on the Dynamic Calibration of Tipping-Bucket Gauges,
W79-04903 2B

CALL, P.
The Water Witch: Fact . . . or Fiction.
W79-04578 7B

CAMPBELL, G. S.
Is the Soil Frozen or Not. An Algorithm Using Weather Records,
W79-04740 2G

CAMPBELL, W. J.
Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

CANAMARE, J. G.
Development of a Thin-Liquid-Film Membrane Unit for Desalination by Reverse Osmosis,
W79-04515 3A

CANTERFORD, G. S.
Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

CAPENER, H. R.
Public Perceptions of Issues and Problems in the Lake Champlain Basin Area, A Summary,
W79-04558 2H

CARBALLADA, L.
Uniformly Discharging Lateral Weirs,
W79-04573 8B

CARKIN, J. B.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

CARLSON, B. A.
Edible-Oil Pollution on Fanning Island,
W79-04841 5B

CARPENTER, E. J.
American Methods for Measuring Phytoplankton Production in the Open Ocean,
W79-04540 5C

CARRIKER, N. E.
Sources, Levels, and Reactions of Boron in Florida Waters,
W79-04603 2K

CARUSO, S. C.
Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

CARY, J. W.
Is the Soil Frozen or Not. An Algorithm Using Weather Records,
W79-04740 2G

CASAPIERI, P.
A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

CASPARIUS, R. E.
Radon in Potable Water Supplies in Maine,
W79-04593 5B

CHANG, A. T. C.
Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

CHANGNON, D.
Winter Storms and the Record-Breaking Winter in Illinois,
W79-04839 2B

CHANGNON, S. A. JR.
Solar Energy Information and Data for Illinois,
W79-04719 2B

Winter Storms and the Record-Breaking Winter in Illinois,
W79-04839 2B

CHAPPELLE, E. W.
Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

CHEE, P. C.
A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

CHEN, K. Y.
Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

CHENOWETH, J. W.
Reverse Osmosis Desalination Apparatus and Method,
W79-04898 3A

CHERKHANOV, YU. P.
Estimation of Organochlorine Pesticide Loss in Surface Runoff Waters,
W79-04655 5B

CHERNOUSOV, YU. I.
Dewatering of High-Ash Sediments of Effluents (Obezvozhivamie vysokozolinykh osadkov stochnykh vod),
W79-04644 5D

CHERRY, D. S.
Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

CHERRY, J. A.
The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

CHESNESS, J. L.
Peach Tree Response to Drip Application of Water and Nutrients,
W79-04981 3F

CHIEPPA, M.
Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

CHILDS, S. W.
A Simplified Model of Corn Growth Under Moisture Stress,
W79-04607 2D

CHIOU, J. Y.
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

CHOU, E. J.
Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

CHOW, T. L.
Hydrologic Behavior of a Forested Mountain Soil in Coastal British Columbia,
W79-04564 2G

CHRISTENSEN, B. A.
Mathematical Methods for Analysis of Fresh Water Lenses in the Coastal Zones of the Floridan Aquifer,
W79-04961 4B

Verification of an Estuarine Model for Apalachicola Bay, Florida,
W79-04582 2L

CLAYTON, M. N.
Morphological Variation and Life History in Cylindrical Forms of Scytosiphon Lomentaria (Scytosiphonaceae: Phaeophyta) from Southern Australia,
W79-04778 5C

CLEMMENS, A. J.
Assessing Trickle Emitter Application Uniformity,
W79-04990 3F

CLIFF, D. D.
Phytoplankton Ecology of Vancouver Harbor,
W79-04617 5B

COLOMBO, P. M.
Occurrence of Endophytic Bacteria in Siphonous Algae,
W79-04783 5C

COLT, J.
Chronic Exposure of Channel Catfish, Ictalurus Punctatus, to Ammonia: Effects on Growth and Survival,
W79-04835 5C

CONKLIN, L. R.
Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

CONRAD, E. T.
A Methodology for Determining Land Value and Associated Benefits Created from Dredged Material Containment,
W79-04933 5E

CONRAD, J. M.
Oil Spills: The Strategy of Recovery,
W79-04904 5C

COOKE, D. G.
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

COOKE, G. D.
Evaluation of Aluminum Sulfate for Phosphorus Control in Eutrophic Lakes,
W79-04958 5C

COOMBS, E. G.
Radon in Potable Water Supplies in Maine,
W79-04593 5B

COON, N. C.
No. 2 Fuel Oil Decreases Embryonic Survival of Great Black-Backed Gulls,
W79-04628 5C

COPELAND, T. L.
Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

CORNISH, B. A.
Economic Performance of Reservoirs a Sensitivity Analysis,
W79-04711 6B

COSTLOW, J. D.
Effects of Temperature and Salinity on the Life Cycle of Ophryotrocha Diadema (Polychaeta, Dorvilleidae),
W79-04823 5C

COUTANT, C. C.
Temperature Influences on Growth of Aquatic Organisms,
W79-04851 5C

COUVILLON, G. A.
Peach Tree Response to Drip Application of Water and Nutrients,
W79-04981 3F

CRIPE, C. R.
An Automated Device (AGARS) for Studying Avoidance of Pollutant Gradients by Aquatic Organisms,
W79-04696 5A

CRITTENDEN, J. C.
Predictive Model for Design of Fixed-Bed Adsorbers: Parameter Estimation and Model Development,
W79-04704 5D

CROCKER, T. D.
Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

CROSS, F. A.
Impact of Radioactivity on the Marine Environment,
W79-04542 5C

CULP, R. L.
Estimating Costs for Water Treatment as a Function of Size and Treatment Plant Efficiency,
W79-04527 6B

CURRAN, H. J.
Analysis of Alaska's Water Use Act and Its Interaction with Federal Reserved Water Rights,
W79-04959 6E

CURTIS, M. W.
Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

CUSHING, C. E.
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

CUSHMAN, R. M.
The Potential Impacts on Aquatic Ecosystems from the Release of Trace Elements in Geothermal Fluids,
W79-04881 5B

DANILOV, G. E.
Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

DAVIES, D. S.
Development of a Thin-Liquid-Film Membrane Unit for Desalination by Reverse Osmosis,
W79-04515 3A

DAVIS, J. E.
Energy and Mass Transfer in Partial-Pressure Distillation,
W79-04940 3A

DAVIS, J. S.
The Interrelationships Among Chemical Parameters in Rivers--Analysing the Effect of Natural and Anthropogenic Sources,
W79-04569 5B

DAVIS, P. H.
The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

DAVIS, S. S.
Deposition of Nonuniform Sediment on Concave Slopes,
W79-04917 2J

DE VRIES, J.
Hydrologic Behavior of a Forested Mountain Soil in Coastal British Columbia,
W79-04564 2G

DEACON, J. E.
Limnological Aspects of Lake Mead, Nevada-Arizona,
W79-04506 2H

DEBOER, D. W.
Economic Analyses of Multiple Pivot Irrigators on a Droughty Soil,
W79-04995 3F

DELAPP, D. F.
By-Products from Saline Water Conversion Plants: A Feasibility Study,
W79-04946 3A

DELLEUR, J. W.
Planning Storm-Drainage Systems for Urban Growth,
W79-04618 6F

DEMCHENKO, A. S.
Hexachlorocyclohexane, Metaphos, and Chlorophos Decomposition in Soil and Their Migration with the Waters of Surface Runoff,
W79-04654 5B

DEMING, J.
Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

DENDROU, S. A.
Planning Storm-Drainage Systems for Urban Growth,
W79-04618 6F

DENNY, P.
Lead Accumulation in Plankton Blooms from Ullswater, The English Lake District,
W79-04819 5C

DERENDYAEVA, T. A.
Possible Use of Transpiration Water Condensate of Sweet Potatoes in Cultivating Plants in Biological Life Support Systems (In Russian),
W79-04758 3F

DETAR, W. R.
Contour Furrow Irrigation with Liquid Manure Using 'Microtubing' for Flow Control,
W79-04982 3F

DEXTER, R. N.
Distribution of Stable Organic Molecules in the Marine Environment: Physical Chemical Aspects. Chlorinated Hydrocarbons,
W79-04559 5C

DI TORO, D. M.
Optics of Turbid Estuarine Waters: Approximations and Applications,
W79-04734 1A

DICKSON, K. L.
A Computer Monitored Aquatic Bioassay System,
W79-04652 5A

Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

DIETRICH, W. F.
Corrosion Test Program,
W79-04677 3A

DINGMAN, S. L.
Drainage Density and Streamflow: A Closer Look,
W79-04736 2E

DISMUKES, E. B.
Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II,
W79-04517 3A

DIXON, P. S.
Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

DODGE, B. F.
Economic Evaluation Study of Distillation of Saline Water by Means of Forced-Circulation Vapor-Compression Distillation Equipment,
W79-04939 3A

DOERSCHIAG, C.
Flash Reactor,
W79-04896 5D

DONNAN, W. W.
Agricultural Drainage Problems in Kern County, California,
W79-04909 5G

DORSET, P.
Oil Shale and the Environment,
W79-04522 6B

DRUEHL, L. D.
Seasonal Growth and Succession of Tropical and Introduced Phytoplankton Cultured in Deep Sea Water,
W79-04772 5C

DUCKER, S. C.
Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

DUCKSTEIN, L.
Input for a Stochastic Control Model of P Loading,
W79-04623 5B

DUFFER, W. R.
Municipal Wastewater Aquaculture,
W79-04528 5D

DUFFIE, J. A.
Energy and Mass Transfer in Partial-Pressure Distillation,
W79-04940 3A

DUGAN, J. T.
Predictive Analyses of Ground-Water Discharges in the Willow Creek Watershed, Northeast Nebraska,
W79-04805 6A

DUKE, H. R.
Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

DUMBADZE, V. Z.
Water Absorption by Plants in a Dry Wind and Under Periodic Spraying with Water (In Russian),
W79-04707 3F

DUMONTELLE, P. B.
Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

DUNNETTE, D. A.
A Geographically Variable Water Quality Index Used in Oregon,
W79-04697 5A

DUPUY, A. J.
Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

DUSABEK, M. R.
Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

DWIGHT, L. P.
Analysis of Alaska's Water Use Act and Its Interaction with Federal Reserved Water Rights,
W79-04959 6E

EARLEY, D. E.
Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

EASTBURN, R. P.
Estimating Evapotranspiration Rates for Corn in Delaware,
W79-04988 2D

ECKERT, J. W.
Design Concepts for In-Water Containment Structures for Marsh Habitat Development,
W79-04925 5E

EDWARDS, J.
Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

EGDORF, S. S.
Limnological Aspects of Lake Mead, Nevada-Arizona,
W79-04506 2H

EGOROV, V. G.
Water Absorption by Plants in a Dry Wind and Under Periodic Spraying with Water (In Russian),
W79-04707 3F

EHLERS, U.
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

EHRLICH, K. F.
Comparison of a High Volume Pump and Conventional Plankton Nets for Collecting Fish Larvae Entrained in Power Plant Cooling Systems,
W79-04703 5A

EICHENBERGER, B.
Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

EISENHAUER, R. J.
Ion-Exchange Pretreatment of Water After Resin Regeneration with Reverse Osmosis Reject Brine,
W79-04505 5F

EISENMANN, J. L.
Donnan Softening as a Pretreatment to Desalination Processes,
W79-04949 3A

ELLIS, B. G.
Nitrate and Phosphorus Runoff Losses from Small Watersheds in Great Lakes Basin,
W79-04535 5C

EMMETT, L. F.
Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

ENGLAND, M.
Management for Minimizing Nitrogen Leaching Losses on Irrigated Sandy Soils,
W79-04980 3F

ERB, R. A.
Bibliography of the Literature on Dropwise Condensation, 1930-64,
W79-04669 3A

ERICKSON, A. E.
Nitrate and Phosphorus Runoff Losses from Small Watersheds in Great Lakes Basin,
W79-04535 5C

ESAIAS, W. E.
American Methods for Measuring Phytoplankton Production in the Open Ocean,
W79-04540 5C

ESHAYA, A. M.
Economic Evaluation Study of Distillation of Saline Water by Means of Forced-Circulation Vapor-Compression Distillation Equipment,
W79-04939 3A

EVANS, S.
Mechanism of Electrode Demineralization,
W79-04672 3A

EVERTS, C. H.
Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

EVSTIGNEEV, I. A.
Dynamics of Effluent Clarification (Dinamika osvetleniya stochnykhvod),
W79-04645 5D

FABUSS, B. M.
Thermodynamic Properties of Saline Water,
W79-04941 3A

FAGAN, D. A.
Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

FARRAR, J.
Mechanism of Electrode Demineralization,
W79-04672 3A

Nucleation and Growth of Ice Crystals,
W79-04673 3A

FAVA, J. A.
Tuberculation of Pearl Dace, Semotilus Margarita (Pisces: Cyprinidae),
W79-04663 6G

Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

FEDOROV, V. D.
Relative Abundance of Sympatric Species and Model of Exponentially Broken Rod (EBR),
W79-04541 5C

FENEMOR, A. D.
Prediction of Deflection for Corrugated Plastic Tubing,
W79-04983 8G

FILIPPOV, G. L.
Physiological Reaction of Different Corn Hybrids to Drought (In Russian),
W79-04708 3F

FINAN, M. A.
Treatment of Water,
W79-04885 5F

FINDLEY, J. E.
Purifying Oil Shale Retort Water,
W79-04883 5D

FINGERMAN, M.
Increased Spontaneous Locomotor Activity in the Fiddler Crab, Uca Pugilator, After Exposure to a Sublethal Concentration of DDT,
W79-04629 5C

FINGERMAN, S. W.
Increased Spontaneous Locomotor Activity in the Fiddler Crab, Uca Pugilator, After Exposure to a Sublethal Concentration of DDT,
W79-04629 5C

FISH, R. E.
Institutional Concerns: The Delaware Experience,
W79-04804 4A

FISHER, M.
Managing the Low-Yield Water Well,
W79-04580 4B

FISHER, W. S.
Ammonia Production Rates of Artemia Salina Under Various Culture Conditions,
W79-04971 5B

FLETCHER, P. W.
Water-Conservation Methods to Meet Pennsylvania's Water Needs,
W79-04598 3D

FLOS, R.
Zinc Content of the Gills of Rainbow Trout (S. Gairdneri) after Treatment with Zinc Solutions under Normoxic and Hypoxic Conditions,
W79-04836 5C

FLOWERS, L. C.
Reverse Osmosis Membranes Containing Graphitic Oxide,
W79-04665 3A

FLUEHLER, H.
A Procedure for Interpolating the Depth Distribution of Soil Moisture Tension (In German),
W79-04723 8B

FLYNN, T. S.
An Evaluation of the Effects of Geothermal Energy Development on Aquatic Biota in the Geysers Area of California,
W79-04962 6G

FOGEL, M. M.
The Development of a Combined Water Quality Index,
W79-04610 6B

FOK, Y-S.
Estimation of Urban Irrigation Water Use and Requirement,
W79-04984 3D

FORSYTHE, T. D.
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

FOSTER, G. R.
Deposition of Nonuniform Sediment on Concave Slopes,
W79-04917 2J

FOWLER, S. W.
Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

FOX, T. M.
A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

FRANCIS, P. S.
Second Report on Fabrication and Evaluation of New Ultrathin Reverse Osmosis Membranes,
W79-04678 3A

FREDERICK, R. H.
Interstorm Relations in Pacific Northwest,
W79-04733 2B

FREEMAN, A. M. III
Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

FRENET-ROBIN, M.
Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary,
W79-04730 2L

FRENKEL, H.
The Effect of Salt Precipitation and High Sodium Concentrations on Soil Hydraulic Conductivity and Water Retention,
W79-04650 2G

FRIETSCHE, R. F.
Impingement and Entrainment of Fishes at the Savannah River Plant and NPDES 316b Demonstration,
W79-04879 5B

FRITZ, E. S.
Federal Water Pollution Control Act: The Sections 316 (A) and 316 (B) Process,
W79-04507 6E

FRITZ, P.
The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

FROMM, G. A.
Phosphate Removal Using Waste Calcium Sulfate,
W79-04977 5D

FRYREAR, D. W.
Parallel Terraces on Flat Slopes,
W79-04915 4A

GAMBOLATI, G.
On the Use of a Main Trend for the Kriging Technique in Hydrology,
W79-04870 2F

GAPONYUK, E. I.
On the Estimation of the Anthropogenic Pollution Effect on the Functional State of the Soil Microflora,
W79-04657 5C

GARDNER, B. D.
Agriculture and Salinity,
W79-04659 5G

GARIFULLIN, F. SH.
Changes in Biochemical Characteristics of Chernozem Soils in the Region of the Western Slope of the Ural Mountains During Irrigation,
W79-04706 2G

GARNER, B. J.
Field Evaluations of Groundwater Control by Trench and Trenchless Methods of Installed Drains--Lower Rio Grande Valley of Texas,
W79-04906 4B

GELHAR, L. W.
Stochastic Analysis of Spatial Variability in Subsurface Flows 2. Evaluation and Application,
W79-04753 2F

GEORGE, J. F.
Walnut Creek Channel Improvement Project, Contra Costa County, California; Hydraulic Model Investigation,
W79-04923 2E

GERVASON, G.
Papermaking Primary Sludges. Dewatering Studies Realized with Different Industrial Devices (Boues primaires de papeterie. Essais de deshydratation realises avec differents appareils industriels),
W79-04581 5D

GHARAATY-SANI, R.
Interceptor Drains on Sloping Land,
W79-04916 4A

GIBSON, A. R.
Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

GIFFORD, G. F.
Hydrologic Impact of Grazing Systems on Infiltration and Runoff: Development of a Model,
W79-04585 2A

GILES, M. L.
Design Concepts for In-Water Containment Structures for Marsh Habitat Development,
W79-04925 5E

GILL, H. S.
Development of Procedures for Selecting and Designing Reusable Dredged Material Disposal Sites,
W79-04934 5E

GILLEY, J. R.
A Simplified Model of Corn Growth Under Moisture Stress,
W79-04607 2D

GILMORE, J. S.
Report of the Denver Workshop on State-Local-Federal Relationships in Socioeconomic Impact Assessment,
W79-04858 6B

GILMOUR, C. M.
Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

GIMMLER, H.
Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

GITTERMAN, H.
Use of Waste Heat for Production of Fresh Water,
W79-04676 3A

GLOERSEN, P.
Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

GLOVER, K. C.
Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

A Computer Program for Simulating Salinity Loads in Streams,
W79-04800 5B

GOERING, H. L.
The Zone-Purification Process as a Method of Preparation of Potable Water from Sea Water,
W79-04936 3A

GOLDBERG, R.
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

GOLDSMITH, R. L.
Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

GOLDSTEIN, R. M.
A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

GOLLAN, A. Z.
Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

GOLOVLEVA, L. A.
Cometabolism of Foreign Compounds,
W79-04658 5B

GOPHEN, M.
The Productivity of Mesocyclops Leuckarti (Claus) in Lake Kinneret (Israel),
W79-04773 5C

GORDOS, J. D.
Subsurface Drain Spacing from Water Table and Outflow Measurements,
W79-04986 4B

GORE, P. H.
Public Perceptions of Issues and Problems in the Lake Champlain Basin Area, A Summary,
W79-04558 2H

GOUSE, S. W.
Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

GRACE, J. B.
The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

GRAHAM, D. S.
Verification of an Estuarine Model for Apalachicola Bay, Florida,
W79-04582 2L

GRAHAM, G.
Treatment of Water,
W79-04885 5F

GRAHAM, N. J. D.
Urban Runoff from a Road Surface--A Water Quality Study,
W79-04567 5B

GRANT, D. M.
The Role of Plant Residues in the Fate of Cadmium in Ecosystems. A Buffer Against Contamination of Water Sources,
W79-04584 5B

GRANT, M. C.
Sampling and Chemical Interpretation of Precipitation for Mass Balance Studies,
W79-04747 2B

GREEN, A. C.
Sewage Treatment System,
W79-04886 5D

GREEN, D. W.
Improvement of the Steady Floating Random Walk Monte Carlo Method Near Straight Line and Circular Boundaries with Application to Groundwater Flow,
W79-04557 2F

GREENE, L. A.
Nitrates in Water Supply Abstractions in the Anglian Region: Current Trends and Remedies under Investigation,
W79-04570 5A

GREGORY, S. V.
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

GRENNEY, W. J.
An Erosion Model for Arid Wildland Watersheds,
W79-04994 2J

GRETHLEIN, H. E.
Anaerobic Digestion and Membrane Separation of Domestic Wastewater,
W79-04597 5D

GRIFFIN, S. G.
Computer Programming Solid Set Systems,
W79-04913 3F

GUARISO, G.
Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

GUARY, J.-C.
Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

GULYAEV, V. V.
Reagent-Free Method of Effluent Neutralization (Bezreagentnyi sposob neitralizatsii stochnykh vod),
W79-04642 5D

GUMERMAN, R. C.
Estimating Costs for Water Treatment as a Function of Size and Treatment Plant Efficiency,
W79-04527 6B

GUSEV, M. V.
The Development of Standard Methods of Measuring Microbiological Production,
W79-04545 5C

GUSHUE, J. J.
Case Studies and Comparative Analyses of Issues Associated with Productive Land Use at Dredged Material Disposal Sites,
W79-04926 5E

GUTJAHR, A. L.
Stochastic Analysis of Spatial Variability in Subsurface Flows 2. Evaluation and Application,
W79-04753 2F

HADAS, A.
The Effect of Salt Precipitation and High Sodium Concentrations on Soil Hydraulic Conductivity and Water Retention,
W79-04650 2G

HAGA, H.
Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

HAGA, Y.
Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

HAGIWARA, H.
Apparatus and Method for Treating Waste-Containing Liquors,
W79-04893 5D

HAINES, E. B.
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight,
W79-04727 2L

HALL, D. K.
Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

HALL, W. A.
An Analysis of Drought Research Needs for Colorado Agriculture,
W79-04964 3B

HAMDY, M. K.
Behavior of Mercury in Bio-Systems II. Depuration of 203HG2+ in Various Trophic Levels,
W79-04619 5B

HAMEEDI, M. J.
Aspects of Water Column Primary Productivity in the Chukchi Sea During Summer,
W79-04765 5C

HAMER, E. A. G.
Reverse Osmosis Membrane Regeneration,
W79-04954 3A

HAMILTON, W. W.
Nucleation and Growth of Ice Crystals,
W79-04673 3A

HAMMERSTROM, K.
Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

HANSEN, D. E.
Water Utilization and Reallocation in Chile: A Study of the Pirque Valley,
W79-04695 6A

HANSEN, D. J.
Impact of Pesticides on the Marine Environment,
W79-04550 5C

HANSEN, N.
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

HANSEN, S. P.
Estimating Costs for Water Treatment as a Function of Size and Treatment Plant Efficiency,
W79-04527 6B

HANSON, E. G.
Potato and Lettuce Response to Irrigation Methods and Practices,
W79-04997 3F

HARPER, G. F.
Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

HARRISON, D. S.
Drip Irrigation of Orange Trees in Humid Climate,
W79-04991 3F

HARTLEY, R. P.
Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

HARTMAN, J. A.
Expression and Repression of Special Interests in Planning and Management of the Meramec Park Reservoir,
W79-04647 6B

HAURY, L.
Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

HAWKINS, R. H.
Hydrologic Impact of Grazing Systems on Infiltration and Runoff: Development of a Model,
W79-04585 2A

HEAD, W. J.
Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

HEATH, R. T.
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

HEATWOLE, G.
Preliminary Assessment of Policy and Management Options for Groundwater Mining in the Great Plains,
W79-04957 4B

HEGGEN, R. J.
Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

HELLAWELL, J. M.
Biological Surveillance of Rivers: A Biological Monitoring Handbook,
W79-04634 7B

HEMENS, J.
Nutrient Budget for a Residential Stormwater Catchment in Durban, South Africa,
W79-04565 5B

HERSHAFT, A.
Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

HESS, C. T.
Radon in Potable Water Supplies in Maine,
W79-04593 5B

HIGLEY, W. S.
Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

HILDEBRAND, S. G.
The Potential Impacts on Aquatic Ecosystems from the Release of Trace Elements in Geothermal Fluids,
W79-04881 5B

HILER, E. A.
Incorporating Crop Needs into Drainage System Design,
W79-04998 4B

HILL, A. R.
Factors Affecting the Export of Nitrate-Nitrogen from Drainage Basins in Southern Ontario,
W79-04735 5B

HILL, D. W.
Ambient Concentrations of PCBs in the Southeast from Storet Data and Selected EPA Studies,
W79-04848 5A

HILL, J. IV.
Mathematical Modeling of Pesticides in the Environment,
W79-04648 5B

HILL, J. M.
Verification of an Estuarine Model for Apalachicola Bay, Florida,
W79-04582 2L

HILL, R. W.
Drainage Requirements for Lowland Rice,
W79-04908 5G

HIMES, R. C.
The Zone-Purification Process as a Method of Preparation of Potable Water from Sea Water,
W79-04936 3A

HINTON, J. F.
Hydrolytic and Photochemical Degradation of Organophosphorus Pesticides,
W79-04682 5B

HIPEL, K. W.
Comparison of Alternative Engineering Designs,
W79-04690 6A

HOBBS, M. F.
Sewage Treatment System,
W79-04886 5D

HOFFMAN, R. J.
Selected Water-Quality Data from the Merced River, California, November 1976 Through August 1977,
W79-04794 5B

HOFFMAN, W. L.
A Socio-Economic Feasibility Study of the Proposed Rochester Dam,
W79-04869 6B

HOLBURT, M. B.
International Problems,
W79-04660 6E

HOLCOMBE, G. W.
Toxic Effects of Zinc on Fathead Minnows Pimephales Promelas in Soft Water,
W79-04837 5C

HOLDEN, W. R.
Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

HOLLEY, E. R.
Temporal Moments for Longitudinal Dispersion,
W79-04732 5B

HOOLEY, D.
A Computer Monitored Aquatic Bioassay System,
W79-04652 5A

HOPKINS, R.
The Effects of Some Pollutants on the Survival Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

HORAK, O.
Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

HORTMANN, W.
Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

HOSHI, K.
Disaggregation of Streamflow Volumes,
W79-04878 2E

HOSMAN, R. L.
Geohydrology of the Northern Louisiana Salt Dome Basin Pertinent to the Storage of Radioactive Wastes--A Progress Report,
W79-04810 5E

HOUGHTON, J. C.
Birth of a Parent: The Wakeby Distribution fo Modeling Flood Flows,
W79-04742 2E

The Incomplete Means Estimation Procedur Applied to Flood Frequency Analysis,
W79-04741 2E

HOWARD, T. E.
Research on Pulp and Paper Industry Water and Effluent Quality Problems -- A Review,
W79-04668 5C

HOWE, C. W.
Economic Issues Related to Large-Scale Water Transfers in the USA,
W79-04759 6D

HSU, C. P.
Paralytic Shellfish Toxins in the Sea Scallop, Placopecten Magellanicus, in the Bay of Fundy,
W79-04825 5A

HU, A.
Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

HUANG, JU-CHANG
Removal of Ammonia Nitrogen from Wastewater by Partial Chlorination Followed by Activated Carbon Treatment,
W79-04556 5D

HUBATA, R.
Investigation of Inorganic Ion Exchange Membranes for Electrodialysis Application,
W79-04942 3A

HUGGINS, L. F.
Deposition of Nonuniform Sediment on Concave Slopes,
W79-04917 2J

HUGHES, G. M.
Zinc Content of the Gills of Rainbow Trout (S. Gairdneri) after Treatment with Zinc Solutions under Normoxic and Hypoxic Conditions,
W79-04836 5C

HULL, J. E.
Summary of Hydrologic Data Collected During 1976 in Dade County, Florida,
W79-04795 7C

HUMPHREY, M. F.
Extracting Lignins from Mill Wastes,
W79-04640 5D

HUNTAMER, D.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

HUNTLEY, D.
On the Detection of Shallow Aquifers Using Thermal Infrared Imagery,
W79-04745 7B

HURWITZ, M.
Heat Transfer in the Liquid-Liquid Spray Tower,
W79-04670 3A

IVERSON, R. L.
Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

Use of Biological Indicators for Monitoring Effect of Pollutants on the Marine Environment,
W79-04546 5C

IVLEVA, T. I.
Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

JACKSON, L. G.
Flat Channel Terraces for Pollution Abatement and Sediment Control,
W79-04914 4A

JEFFERS, E. L.
Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

JEFFREY, E. A.
Benefits and Costs of Water Quality Improvements,
W79-04699 6B

JEFFREY, L. M.
Volatile Liquid Hydrocarbons in the Surface Coastal Waters of the Gulf of Mexico,
W79-04560 5C

JENNINGS, J. R.
Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. I. Accumulation from Seawater and a Food Source,
W79-04968 5A

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. II. Preliminary Investigation of Cadmium-Binding Proteins,
W79-04969 5A

JENSON, V. B.
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

JOHNSON, R. R.
Dry Matter Production and Translocation in Maize Subjected to Drought During Grain Fill,
W79-04606 2I

JOHNSTON, W. R.
Financing Regional Drainage Facilities Under 1978 Economic Conditions,
W79-04911 5G

JONES, F.
Pollution of a Water Supply Catchment by Breeding Gulls and the Potential Environmental Health Implications,
W79-04843 5B

JONES, T. I.
Treatment of Water,
W79-04885 5F

JORDAN, P. R.
Loss of High Flows by Seepage from Stream Channels in Kansas,
W79-04577 4A

JOYCE, T. W.
Removal of Color from Carbonate Pulping Effluent -- The Calcium-Magnesium Coagulation Process,
W79-04635 5D

JURGENS, S. K.
Dry Matter Production and Translocation in Maize Subjected to Drought During Grain Fill,
W79-04606 2I

JURINAK, J. J.
An Erosion Model for Arid Wildland Watersheds,
W79-04994 2J

JURY, W. A.
The Effect of Salt Precipitation and High Sodium Concentrations on Soil Hydraulic Conductivity and Water Retention,
W79-04650 2G

JUSTICE, C. A.
Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

KACZMAREK, Z.
Tisza and Vistula River Basins: Case Studies,
W79-04687 6A

KAIN, J. M.
The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

KALISH, R. L.
Reverse Osmosis Membrane Regeneration,
W79-04954 3A

KALMAZ, E. V.
Added Chlorine in Aquatic Environments,
W79-04899 5C

KARIYA, T.
Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

KARMELI, D.
Allocation Procedure of Water and Land Resources in Relation to Some Irrigation Quality Parameters,
W79-04700 6A

KASAI, M.
Ion Exchange Process,
W79-04895 5D

KAUFMAN, D. D.
Pesticide Transport and Metabolism in Model Systems,
W79-04661 5B

KAWASAKI, Y.
Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

KEARNEY, P. C.
Pesticide Transport and Metabolism in Model Systems,
W79-04661 5B

KEIFER, C. J.
Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

KEILIN, B.
Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

KEISLING, T. C.
Calcium-Supplying Characteristics of Two Gypsum Materials on Southeastern Coastal Plain Soils,
W79-04662 2G

KELLER, F.
Preliminary Assessment of Policy and Management Options for Groundwater Mining in the Great Plains,
W79-04957 4B

KELSO, J. R. M.
Entrainment of Larval Fish by the Douglas Point Generating Station, Lake Huron, in Relation to Seasonal Succession and Distribution,
W79-04816 5C

KEMPER, C. A.
Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

KENNEDY, R. H.
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

KESTING, R. E.
Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

KHABIROV, I. K.
Changes in Biochemical Characteristics of Chernozem Soils in the Region of the Western Slope of the Ural Mountains During Irrigation,
W79-04706 2G

KHAZIEV, KH.
Changes in Biochemical Characteristics of Chernozem Soils in the Region of the Western Slope of the Ural Mountains During Irrigation,
W79-04706 2G

KIDD, C. H. R.
A Note on the Dynamic Calibration of Tipping-Bucket Gauges,
W79-04903 2B

KILTY, K. T.
Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

KING, D.
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

KING, L. G.
Interceptor Drains on Sloping Land,
W79-04916 4A

KING, W. M.
A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

KLEHR, E. H.
Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

KLEPER, M. H.
Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

KNOTTEK, R. K.
Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

KNOWLES, G.
Enhancement of Water-Quality Monitoring Systems by Incorporating Water-Quality Modelling and Time-Series Analysis,
W79-04571 5B

A Mathematical Deterministic River-Quality Model. Part I: Formulation and Description,
W79-04721 5B

KNOWLES, S. C.
Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

KOBZEV, V. A.
On the Estimation of the Anthropogenic Pollution Effect on the Functional State of the Soil Microflora,
W79-04657 5C

KOHL, A. L.
Development of Direct Contact Condensation Multistage Flash Distillation Process: Phase II,
W79-04521 3A

KOMINEK, O.
Application of Reverse Osmosis and Ultrafiltration to Purification of Pulp and Paper Industry Effluents. VI. Purification of Pulp Bleaching Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego),
W79-04632 5D

KONIKOV, L. F.
Computer Model of Two-Dimensional Solute Transport and Dispersion in Ground Water,
W79-04813 6A

KORNEGAY, F. C.
A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

KOROTOVA, L. G.
Hexachlorocyclohexane, Metaphos, and Chlorophos Decomposition in Soil and Their Migration with the Waters of Surface Runoff,
W79-04654 5B

KOSIK, A. T.
Rate of Capillary Water Ascent as Dependent on Physical Soil Properties, (In Czech),
W79-04751 2G

KOWALSKA, E.
Application of Reverse Osmosis and Ultrafiltration to Purification of Pulp and Paper Industry Effluents. VI. Purification of Pulp Bleaching Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego),
W79-04632 5D

KOZASA, E.
The Effects of Heated Effluents on the Production of Marine Plankton (Takahama Nuclear Power Station-I) (In Japanese),
W79-04842 5B

KREMER, B. P.
Studies on 14CO2-Assimilation in Marine Rhodophyceae,
W79-04766 5C

KREMER, S. S.
Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

KREUTZIGER, K. M.
Case Studies and Comparative Analyses of Issues Associated with Productive Land Use at Dredged Material Disposal Sites,
W79-04926 5E

KRUSE, E. G.
Groundwater and Salinity in the Grand Valley of Colorado,
W79-04985 5G

KUBOTA, S. S.
Studies on Toxic Effects of Pesticides on Fish-I Toxic Effects of the Herbicide, Molinate, o Carp,
W79-04828 5

Studies on Toxic Effects of Pesticides on Fish II Toxic Effects of the Herbicide, Benthiocarb on Carp. (In Japanese),
W79-04826 5

KUCHIN, G. P.
Dynamics of Effluent Clarification (Dinamik osvetleniya stochnykhvod),
W79-04645 5I

KUIPER, L. K.
The Computational Efficiency and Taylor Expansion Derivation of Approximating Equation to the Groundwater Flow Equation,
W79-04737 2

KUMAGAI, H.
Contents of Total Mercury, Alkyl Mercury, an Methyl Mercury in Some Coastal Fish an Shells,
W79-04589 5A

KUMANO, S.
Notes on Freshwater Red Algae from West Ma laysia,
W79-04768 5

KUNZ, K. L.
Public Groundwater Supplies in Warre County,
W79-04720 7

KURIS, A.
Ultrasonic Oil Spill Removal,
W79-04882 5

LACEY, R. E.
Transport of Electrolytes Through Membran Systems, Second Annual Report,
W79-04952 3A

LAFLEN, J. M.
Design and Operation of Gradient Terrace Sys tems,
W79-04918 2

LAMB, T. E.
Water-Quality Investigation of the Yellville Wa tershed, Arkansas,
W79-04802 7

LAMBERTI, G. A.
An Evaluation of the Effects of Geotherma Energy Development on Aquatic Biota in th Geysers Area of California,
W79-04962 6

LANNERGREN, C.
The Spring Phytoplankton Bloom in Lindaspol lene, A Landlocked Norwegian Fjord. II. Bio mass and Activity of Net-and Nanoplankton
W79-04784 5

LAPI, J. L.
Public Perceptions of Issues and Problems in th Lake Champlain Basin Area, A Summary,
W79-04558 2

LAPINA, N. F.
Certain Laws of Organochlorine Pesticide Re distribution in the Soil-Water, Soil-Plant System
W79-04921 5

LAPPALA, E. G.
Predictive Analyses of Ground-Water Dis charges in the Willow Creek Watershed, North east Nebraska,
W79-04805 6A

LARRICK, S. R.
Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

LATHIS, S. G.
Removal of Color from Carbonate Pulping Effluent -- The Calcium-Magnesium Coagulation Process,
W79-04635 5D

LAVOIE, D. M.
A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

LAW, R. J.
Determination of Petroleum Hydrocarbons in Water, Fish and Sediments Following the Ekofisk Blow-Out,
W79-04976 5A

LEAVENS, J. M.
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

LEBEDEV, G. V.
Water Absorption by Plants in a Dry Wind and Under Periodic Spraying with Water (In Russian),
W79-04707 3F

LEE, R.
U.S. Geological Survey's Role in the Collection and Analysis of Peak-Flow Data on the Island of Oahu, Hawaii,
W79-04812 2E

LEE, R. G.
Institutional Change and Fire Management,
W79-04966 6E

LEHRER, Y.
The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

LEIGH, J. H.
Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

LEINROTH, J. P. JR.
Washing of Brine from Ice Crystals,
W79-04674 3A

LEITHISER, R. M.
Comparison of a High Volume Pump and Conventional Plankton Nets for Collecting Fish Larvae Entrained in Power Plant Cooling Systems,
W79-04703 5A

LEMAN, B. J. O.
Process for the Purification of Greasy and Soiled Water Using a Heavy Solvent, and Apparatus for its Implementation,
W79-04890 5D

LEONE, H. L. JR.
Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

LESLIE, J. K.
Entrainment of Larval Fish by the Douglas Point Generating Station, Lake Huron, in Relation to Seasonal Succession and Distribution,
W79-04816 5C

LEUNG, W. K.
An Analytical Model for Establishing Water Resources Development Priorities,
W79-04586 6B

LEWIS, B. G.
A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

LEWIS, M.
Acute Toxicity of Copper, Zinc and Manganese in Single and Mixed Salt Solutions to Juvenile Longfin Dace, Agosia Chrysogaster,
W79-04833 5C

LEWIS, W. M. JR.
Sampling and Chemical Interpretation of Precipitation for Mass Balance Studies,
W79-04747 2B

LI, W. K. W.
Kinetic Analysis of Interactive Effects of Cadmium and Nitrate on Growth of Thalassiosira Fluviatilis (Bacillariophyceae),
W79-04587 5A

LIESEMEYER, W. W.
Flat Channel Terraces for Pollution Abatement and Sediment Control,
W79-04914 4A

LIGETT, R. W.
Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II,
W79-04517 3A

LIN, S. T.
Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

LINDENBORG, K. H.
Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

LIONBERGER, H. F.
Expression and Repression of Special Interests in Planning and Management of the Meramec Park Reservoir,
W79-04647 6B

LIOTTA, F. P.
Dissolved Oxygen Demand of Reduced Chemical Species in the Water Column of Sebasticook Lake, Maine,
W79-04684 2H

LIPIRO, D. J.
Development of Procedures for Selecting and Designing Reusable Dredged Material Disposal Sites,
W79-04934 5E

LISO, R.
Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

LITAV, M.
The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

LIU, C. C.
A Nonlinear Analysis of the Relationship Between Rainfall and Runoff for Extreme Floods,
W79-04604 2A

LOBBAN, C. S.
The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

LOF, O. G.
Energy and Mass Transfer in Partial-Pressure Distillation,
W79-04940 3A

LOMEN, D. O.
Time-Dependent Solutions to the One-Dimensional Linearized Moisture Flow Equation with Water Extraction,
W79-04602 2G

LONG, R. B.
Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

LONSDALE, H. R.
Reverse Osmosis for Water Desalination,
W79-04516 3A

LOWREY, R. A.
Methodology for Designing Cost-Effective Monitoring and Compliance Strategies for Pesticide Use,
W79-04524 6A

LUCKEY, R. R.
Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

LUDWICK, A. E.
Nitrogen Sources for Hay Production on Flooded Meadows,
W79-04653 3F

LYMIN, M.
Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

MABES, D. L.
A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

MACDONALD, D. V.
Quality Considerations for Water Supply Evaluations,
W79-04714 6B

MACMILLAN, J. R.
Stochastic Analysis of Spatial Variability in Subsurface Flows 2. Evaluation and Application,
W79-04753 2F

MAIDMENT, D.
Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

MAKAROVA, L. A.
Dynamics of Effluent Clarification (Dinamika osvetleniya stochnykhvod),
W79-04645 5D

MAKSIMOVA, L. A.
Physiological Reaction of Different Corn Hybrids to Drought (In Russian),
W79-04708 3F

MALMQUIST, P-A.
Atmospheric Fallout and Street Cleaning-Effects on Urban Storm Water and Snow,
W79-04568 5B

MANAHAN, S. E.
Coal Humic Substances for the Treatment of Wastewater from Stack Gas Scrubbers, Coal Conversion Plants, and Other Coal Utilization Facilities,
W79-04554 5D

MANGES, H. L.
Sizing Tailwater Recovery Systems to Utilize Runoff from Precipitation on Irrigated Lands,
W79-04960 3F

MANN, D. E.
Water Policy and Decision-Making in the Colorado River Basin,
W79-04868 6E

MAO, T. L.
Sizing Tailwater Recovery Systems to Utilize Runoff from Precipitation on Irrigated Lands,
W79-04960 3F

MARCHAND, A.
Paralytic Shellfish Toxins in the Sea Scallop, Placopecten Magellanicus, in the Bay of Fundy,
W79-04825 5A

MARCUM, L. L.
Institutional Arrangements for Effective Water Management in Colorado,
W79-04503 6E

MARSEE, C. W.
Drainage Installation Equipments 'Economics of the Art',
W79-04910 5G

MARSHALL, D. W.
Filter Belts vs. Pressure in Dewatering of Sludges,
W79-04641 5D

MARTIN, D.
Management for Minimizing Nitrogen Leaching Losses on Irrigated Sandy Soils,
W79-04980 3F

MARTIN, J. H.
Impact of Metals on the Marine Environment,
W79-04552 5C

MARTIN, W. E.
Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

MAURER, D. L.
Vertical Migration of Benthos in Simulated Dredged Material Overburdens; Vol. I: Marine Benthos,
W79-04931 5E

MAXIMOV, V.
Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

MAYS, L. W.
Sewer Network Scheme for Digital Computations,
W79-04590 5D

MCCOLL, R. H. S.
Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

MCCOMAS, M. R.
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

MCCUEN, R. H.
Simulation of Urban Non-Point Source Pollution,
W79-04609 5B

MCDONALD, K. L.
A Colorimetric Analysis for Abietic-Type Resin Acids in Pulping Effluents,
W79-04636 5A

MCDONALD, R. C.
Upgrading Faculative Wastewater Lagoons with Vascular Aquatic Plants,
W79-04830 5D

MCELRAVY, E.
An Evaluation of the Effects of Geothermal Energy Development on Aquatic Biota in the Geysers Area of California,
W79-04962 6G

MCFARLANE, R. W.
Impingement and Entrainment of Fishes at the Savannah River Plant and NPDES 316b Demonstration,
W79-04879 5B

MCKINSTRY, W. E.
Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

MCLEOD, R. S.
Water-Level Declines in the Madison Area, Dane County, Wisconsin,
W79-04809 7C

MCNULTY, K. J.
Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

MCWHORTER, D. B.
Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

MEERSMAN, J. J.
Environmental Considerations in Three Infrastructure Planning Agencies: An Overview of Research Findings,
W79-04680 6E

MENZEL, D. C.
Speculative Policy Making in the Environmental Arena,
W79-04613 6E

MERRINER, J. V.
Factors Affecting Accuracy of Ichthyoplankton Samples Used in Power Plant Entrainment Studies,
W79-04504 5C

MERTON, U.
Reverse Osmosis for Water Desalination,
W79-04516 3A

METER, C. V. JR.
Increased Spontaneous Locomotor Activity in the Fiddler Crab, Uca Pugilator, After Exposure to a Sublethal Concentration of DDT,
W79-04629 5C

MICHALSON, E. L.
Economics of On-Farm Methods of Controlling Sediment Loss from Surface-Irrigated Fields,
W79-04756 4D

MICHENER, D. W.
Subsurface Drain Spacing from Water Table and Outflow Measurements,
W79-04986 4B

MIL'VIDAS, A.-V. S.
Dewatering of High-Ash Sediments of Effluents (Obezvozhivamie vysokozolinykh osadkov stochnykh vod),
W79-04644 5D

MILLER, D. E.
Corn Residue Management to Reduce Erosion in Irrigation Furrows,
W79-04724 4D

Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

MILLER, D. R.
Pennsylvania Annual Progress Report, 1978,
W79-04797 7C

MILLER, S. E.
The Zone-Purification Process as a Method of Preparation of Potable Water from Sea Water,
W79-04936 3A

MINTZ, M. S.
Transport of Electrolytes Through Membrane Systems, Second Annual Report,
W79-04952 3A

MIRACLE, R. D.
Impingement and Entrainment of Fishes at the Savannah River Plant and NPDES 316b Demonstration,
W79-04879 5B

MIRONOV, O. G.
Oil and Marine Organisms,
W79-04551 5C

MISTINA, J.
Rate of Capillary Water Ascent as Dependent on Physical Soil Properties, (In Czech),
W79-04751 2G

MISUMI, T.
Ion Exchange Process,
W79-04895 5D

MITCHELL, B. D.
Cyclomorphosis in Daphnia Carinata King (Crustacea: Cladocera) from Two Adjacent Sewage Lagoons in South Australia,
W79-04821 5C

MIYAJI, T.
Ion Exchange Process,
W79-04895 5D

MOELLER, R. E.
Nitrogen-Fixation in the Littoral Benthos of an Oligotrophic Lake,
W79-04776 5C

MOFFETT, W. L.
Ammonia Production Rates of Artemia Salina Under Various Culture Conditions,
W79-04971 5B

MOHAMMAD, M-B. M.
Annual Cycles of Some Cladocerans in a Polluted Stream,
W79-04820 5C

MOORE, J. B.
The Application of Optimal Linear Regulator Theory to a Problem in Water Pollution,
W79-04596 7B

MORCH, E.
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

MOREAU, D. H.
Water Quality Planning in North Carolina,
W79-04922 6E

MOROZOVA, G. K.
Estimation of Organochlorine Pesticide Loss in Surface Runoff Waters,
W79-04655 5B

MORRIS, I.
Products of Photosynthesis in Natural Populations of Marine Phytoplankton from the Gulf of Maine.
W79-04763 5C

MORRISON, S.
Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

MORTVEDT, J. J.
Nutrient Effectiveness in Relation to Rates Applied for Pot Experiments: I. Nitrogen and Potassium,
W79-04992 2G

Nutrient Effectiveness in Relation to Rates Applied for Pot Experiments: II. Phosphorus Sources,
W79-04993 2G

MOSS, B.
The Ecological History of a Mediaeval Man-Made Lake, Hickling Broad, Norfolk, United Kingdom,
W79-04777 5C

MOYER, J. E.
Municipal Wastewater Aquaculture,
W79-04528 5D

MUEHLETHALER, E. T.
Toxicity Removal by Primary Treatment (of Kraft Pulp Mill Effluent),
W79-04637 5D

MUELLER, J. C.
Research on Pulp and Paper Industry Water and Effluent Quality Problems -- A Review,
W79-04668 5C

MULLER-FEUGA, A.
The Influence of Temperature and Wet Weight on the Oxygen Demand of Rainbow Trout (Salmo Gairdneri R.) in Fresh Water,
W79-04832 5C

MULLER, R.
Behavior of Water in Various States,
W79-04951 1A

MUNDEN, G.
Process for Treating Caustic Wash Solutions,
W79-04889 5D

MURABAYASHI, E. T.
Estimation of Urban Irrigation Water Use and Requirement,
W79-04984 3D

MURPHY, G. W.
The Osmionic Process,
W79-04948 3A

MURSKAYA, M. L.
Dewatering of High-Ash Sediments of Effluents (Obezvozhivamie vysokozolinykh osadkov stochnykh vod),
W79-04644 5D

MYERS, D.
Oil Shale and the Environment,
W79-04522 6B

MYERS, J. M.
Drip Irrigation of Orange Trees in Humid Climate,
W79-04991 3F

NAIMAN, R. J.
Transport of Nutrients and Carbon from the Nanaimo River to its Estuary,
W79-04726 2L

NAKAYAMA, F. S.
Assessing Trickle Emitter Application Uniformity,
W79-04990 3F

NAKAYAMA, O.
Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

NAMSARAEVA, A. KH.
Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

NAMSARAEVA, V. R.
Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

NARASIMHAN, T. N.
Numerical Model for Saturated-Unsaturated Flow in Deformable Porous Media. 3. Applications,
W79-04749 2G

NASH, R. G.
Pesticide Transport and Metabolism in Model Systems,
W79-04661 5B

NDU, F. O. C.
The Role of Plant Residues in the Fate of Cadmium in Ecosystems. A Buffer Against Contamination of Water Sources,
W79-04584 5B

NEAL, F. C.
Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

NEVISSI, A.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

NEW, L. L.
Use of Methanol-Water Solutions for Freeze Protection of Tensiometers,
W79-04605 3F

NEWCOMB, E. H.
Pathway and Products of CO2-Fixation by Green Prokaryotic Algae in the Cloacal Cavity of Diplosoma Virens,
W79-04787 5C

NEWMAN, J. S.
Inactivation of Polioviruses and Coxsackieviruses in Surface Water,
W79-04591 5B

NICHOLSON, H. P.
Predicting and Simulating Pesticide Transport from Agricultural Land: Mathematical Model Development and Testing,
W79-04920 5B

NILSEN, G. B.
A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

NORTH, R. M.
A Viable Methodology to Implement the Principles and Standards,
W79-04692 6A

NORTON, S. A.
Radon in Potable Water Supplies in Maine,
W79-04593 5B

O'BRIEN, R. T.
Inactivation of Polioviruses and Coxsackieviruses in Surface Water,
W79-04591 5B

O'HANLON, P. W.
'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

OCHIAI, T.
Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

Studies on Toxic Effects of Pesticides on Fish - II Toxic Effects of the Herbicide, Benthiocarb, on Carp. (In Japanese),
W79-04826 5C

OCKELMANN, K. W.
The Biology, Ecology, and Behavior of the Bivalve Mysella Bidentata (Montagu),
W79-04764 5C

OGINO, C.
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

OGLESBY, R. T.
Phosphorus Loadings to Lakes and Some of Their Responses. Part 1. A New Calculation of Phosphorus Loading and Its Application to 13 New York Lakes,
W79-04621 5B

Phosphorus Loadings to Lakes and Some of Their Responses. Part 2. Regression Models of Summer Phytoplankton Standing Crops, Winter Total P, and Transparency of New York Lakes with Known Phosphorus Loadings,
W79-04622 5B

OHNO, M.
Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

OKAMOTO, Y.
Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

OLOSKY, C. J.
Subsurface Drain Spacing from Water Table and Outflow Measurements,
W79-04986 4B

OLSEN, S.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

ORTIZ, N. V.
Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

ORTNER, P. B.
Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

ORTOLANO, L.
Environmental Considerations in Three Infrastructure Planning Agencies: An Overview of Research Findings,
W79-04680 6E

OSHIMA, Y.
Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

OSMOND, C. B.
Pathway and Products of CO2-Fixation by Green Prokaryotic Algae in the Cloacal Cavity of Diplosoma Virens,
W79-04787 5C

OTTERBY, M. A.
Economic Analyses of Multiple Pivot Irrigaton on a Droughty Soil,
W79-04995 3F

OTTMANN, F.
Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary,
W79-04730 2L

OWERS, P.
A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

OZISIK, M. N.
Three-Dimensional Temperature Model for Shallow Lakes,
W79-04731 5B

PACK, A. J.
A Methodology for Determining Land Value and Associated Benefits Created from Dredged Material Containment,
W79-04933 5E

PAFFENHOFER, G. A.
Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

PALERMO, M. R.
Needs and Areas of Potential Application of Disposal Area Reuse Management (DARM),
W79-04930 5E

PANATTONI, L.
The Arno River Flood Study (1971-1976),
W79-04725 2E

PANI, B. S.
Sluice Gates with High Discharge Coefficients,
W79-04572 8C

PAPENDICK, R. I.
Is the Soil Frozen or Not. An Algorithm Using Weather Records,
W79-04740 2G

PARKER, T.
Oil Shale and the Environment,
W79-04522 6B

PARKS, L. L.
Water Utilization and Reallocation in Chile: A Study of the Pirque Valley,
W79-04695 6A

PATEL, B.
Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

PATEL, S.
Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

PAULSON, L. J.
Limnological Aspects of Lake Mead, Nevada-Arizona,
W79-04506 2H

PAVLOU, S. P.
Distribution of Stable Organic Molecules in the Marine Environment: Physical Chemical Aspects. Chlorinated Hydrocarbons,
W79-04559 5C

PAWAR, S.
Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

PEREZ, K. T.
Persistence Limits in Ecological Systems,
W79-04548 5C

PERONA, M. J.
The Effect of Recreation on Water Quality,
W79-04963 5B

PERRY, R.
Urban Runoff from a Road Surface--A Water Quality Study,
W79-04567 5B

PETERSEN, G. H.
Life Cycles and Population Dynamics of Marine Benthic Bivalves from the Disko Bugt Area of West Greenland,
W79-04767 5C

PETERSON, F. L.
Waste Injection into a Two-Phase Flow Field: Sand-Box and Hele-Shaw Models Study,
W79-04599 5E

PETIT, J.
The Influence of Temperature and Wet Weight on the Oxygen Demand of Rainbow Trout (Salmo Gairdneri R.) in Fresh Water,
W79-04832 5C

PHILLIPS, A. L.
Drainage Requirements for Lowland Rice,
W79-04908 5G

PHILLIPS, D. J. H.
Trace Metals in the Common Mussel, Mytilus Edulis (L.), and in the Alga Fucus Vesiculosus (L.) from the Region of the Sound (Oresund),
W79-04840 5B

PHILLIPS, M. A.
Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

PICCIOLO, G. L.
Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

PITMAN, J. I.
Carbonate Chemistry of Groundwater from Tropical Tower Karst in South Thailand,
W79-04752 2F

PLIZGA, M.
Investigation of Inorganic Ion Exchange Membranes for Electrodialysis Application,
W79-04942 3A

PODALL, H. E.
Permeability Requirements of Membranes for Use in Desalination by Reverse Osmosis,
W79-04679 3A

Recommended Procedures for the Testing and Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
W79-04944 3A

POLLAKOWSKI, H. O.
Economic Valuation of Shoreline,
W79-04620 6B

PONCE, V. M.
Generalized Stability Analysis of Channel Banks,
W79-04574 8D

POPE, W.
Urban Runoff from a Road Surface--A Water Quality Study,
W79-04567 5B

POPOV, E. E.
Certain Laws of Organochlorine Pesticide Redistribution in the Soil-Water, Soil-Plant System,
W79-04921 5B

POPOV, V. V.
Reagent-Free Method of Effluent Neutralization (Bezreagentnyi sposob neitralizatsii stochnykh vod),
W79-04642 5D

POTTHAST, R.
Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

PRABHV, N. V.
Behavior of Mercury in Bio-Systems II. Depuration of 203HG2+ in Various Trophic Levels,
W79-04619 5B

PRAKASH, A.
Optimal Sequence of Incremental Precipitation,
W79-04901 2A

PREUS, P.
Flotation Means for Barrier for Water Carried Pollutants and Method of Making Same,
W79-04891 5G

PRICE, J. E.
Environmental Considerations in Three Infrastructure Planning Agencies: An Overview of Research Findings,
W79-04680 6E

PRIEGEL, G. R.
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

QUINLAN, T. B.
Public Perceptions of Issues and Problems in the Lake Champlain Basin Area, A Summary,
W79-04558 2H

RAB, E.
Continuous Standard Water Delivery System for Bioassays with Aquatic Organisms,
W79-04770 5C

RACHINSKII, V. V.
Basic Mathematical Models of Toxicant Transport Through the Soil Profile,
W79-04649 5B

RAINBOW, P. S.
Studies on the Uptake of Cadmium by the Cra Carcinus Maenas in the Laboratory. I. Accumulation from Seawater and a Food Source,
W79-04968 5A

Studies on the Uptake of Cadmium by the Cra Carcinus Maenas in the Laboratory. II. Preliminary Investigation of Cadmium-Binding Proteins,
W79-04969 5A

RAMAMURTHY, A. S.
Sluice Gates with High Discharge Coefficients,
W79-04572 8C

Uniformly Discharging Lateral Weirs,
W79-04573 8B

RAMER, J. L.
Apparatus for Treating Sewage,
W79-04888 5D

RASTER, T. E.
Development of Procedures for Selecting and Designing Reusable Dredged Material Disposal Sites,
W79-04934 5E

RATHBURN, R. E.
Laboratory Studies of Gas Tracers for Reaeration,
W79-04712 5A

RAVELO, C. J.
Incorporating Crop Needs into Drainage System Design,
W79-04998 4B

RAZULIS, M. K.
Method for Detecting Water Pollutants,
W79-04897 5A

REARDON, E. J.
The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

RECTOR, M. R.
Agricultural Drainage Problems in Kern County, California,
W79-04909 5G

REDDELL, D. L.
Incorporating Crop Needs into Drainage System Design,
W79-04998 4B

REEVE, R. C.
Trenchless Drainage,
W79-04912 8A

REID, G. W.
Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

REID, W.
An Analytical Model for Establishing Water Resources Development Priorities,
W79-04586 6B

RESH, V. H.
An Evaluation of the Effects of Geothermal Energy Development on Aquatic Biota in the Geysers Area of California,
W79-04962 6G

RICE, R. C.
Delayed Aquifer Yield as a Phenomenon of Delayed Air Entry,
W79-04744 2G

RICHARD, F.
A Procedure for Interpolating the Depth Distribution of Soil Moisture Tension (In German),
W79-04723 8B

RIEDINGER , A.
Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

RIGGLE, F. R.
Rapid Determination of Soil Water Characteristic by Thermocouple Psychrometry,
W79-04987 2G

RIGGS, D. B.
Water Law - Rights of Importers and Developers of Water. City and County of Denver v. Fulton Irrigating Ditch Co., 506 P.2d 144 (Colo. 1972),
W79-04594 6E

RIISGARD, H. U.
Effect of Copper on Volume Regulation in the Marine Flagellate Dunaliella Marina,
W79-04972 5C

RILEY, R. L.
Reverse Osmosis for Water Desalination,
W79-04516 3A

RINALDI, S.
Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

RITTER, W. F.
Estimating Evapotranspiration Rates for Corn in Delaware,
W79-04988 2D

RIVKIN, R. B.
Effects of Lead on Growth of the Marine Diatom Skeletonema Costatum,
W79-04600 5C

ROBBINS, S. K.
Stony Brook Harbor: An Interdisciplinary Analysis,
W79-04862 6B

RODAKOWSKI, R.
A Proposed Method of Evaluating Flood Damages to Historic Homes--An Externality Approach,
W79-04702 6B

RODGERS, E. B.
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

ROED, K. H.
A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

ROGERS, P.
Analyzing the Impact of Land Use on Sewer Service Area Planning,
W79-04701 6A

On the Choice of the 'Appropriate Model' for Water Resources Planning and Management,
W79-04612 6A

ROMAN, M.
Pilot-Plant Study of Two-Stage Chemical-Biological Purification of Pulping Effluents at the Ostroleka Pulp and Paper Mill (Badania poltechniczne nad oczyszczaniem sciekow celulozowych z Ostroleckich Zakladow Celulozowo-Papierniczych w Ukladzie Dwustopniowym Chemiczno-Biologicznym),
W79-04631 5D

ROSKOSKI, J. P.
Nitrogen-Fixation in the Littoral Benthos of an Oligotrophic Lake,
W79-04776 5C

ROSTOVTSEV, V. I.
Electrochemical Coagulation of Industrial Effluents (Elektrokhimicheskaya koagulyatsiya promyshlennykh stokov),
W79-04630 5D

RUCKS, A. C.
A Model for Determining the Impact of Control Costs on Municipal Finances,
W79-04698 6C

RUKVICHAI, C.
Reservoir System Operating Policy--Case Study,
W79-04616 6A

RUMBURG, C. B.
Nitrogen Sources for Hay Production on Flooded Meadows,
W79-04653 3F

RUSSELL, D. J.
Edible-Oil Pollution on Fanning Island,
W79-04841 5B

RUTHERFORD, C. L.
A Simple Method for Screening Petroleum Effluents by In Vitro Enzyme Inhibition,
W79-04902 5C

SABAUT, J. J.
The Influence of Temperature and Wet Weight on the Oxygen Demand of Rainbow Trout (Salmo Gairdneri R.) in Fresh Water,
W79-04832 5C

SACKETT, W. M.
Volatile Liquid Hydrocarbons in the Surface Coastal Waters of the Gulf of Mexico,
W79-04560 5C

SAEKI, K.
Contents of Total Mercury, Alkyl Mercury, and Methyl Mercury in Some Coastal Fish and Shells,
W79-04589 5A

SAGAR, B.
Galerkin Finite Element Procedure for Analyzing Flow Through Random Media,
W79-04859 2F

SAGE, B.
Flare Up Over North Sea Birds,
W79-04900 5C

SALTONSTALL, C.W.
Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

SALTONSTALL, C. W. JR.
A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

SAMMIS, T. W.
Potato and Lettuce Response to Irrigation Methods and Practices,
W79-04997 3F

SANDERSON, E. W.
Public Groundwater Supplies in Warren County,
W79-04720 7C

SANTELICES, B.
New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

SAUER, T. C. JR.
Volatile Liquid Hydrocarbons in the Surface Coastal Waters of the Gulf of Mexico,
W79-04560 5C

SAURET, G.
Papermaking Primary Sludges. Dewatering Studies Realized with Different Industrial Devices (Boues primaires de papeterie. Essais de deshydratation realises avec differents appareils industriels),
W79-04581 5D

SAYLER, G. S.
Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

SCHAEFER, F. T.
Institutional Concerns: The Delaware Experience,
W79-04804 4A

SCHAFFNER, W. R.
Phosphorus Loadings to Lakes and Some of Their Responses. Part 1. A New Calculation of Phosphorus Loading and Its Application to 13 New York Lakes,
W79-04621 5B

Phosphorus Loadings to Lakes and Some of Their Responses. Part 2. Regression Models of Summer Phytoplankton Standing Crops, Winter Total P, and Transparency of New York Lakes with Known Phosphorus Loadings,
W79-04622 5B

SCHELL, W. R.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

SCHERFIG, J.
Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

SCHILLER, R. W.
Ion-Exchange Pretreatment of Water After Resin Regeneration with Reverse Osmosis Reject Brine,
W79-04505 5F

SCHMIDT, F. F.
Public Perceptions of Issues and Problems in the Lake Champlain Basin Area, A Summary,
W79-04558 2H

SCHMITZ, R. A.
Reduction of Aqueous HOCl with Activated Carbon,
W79-04615 5F

SCHNEIDER, R.
Report of the Denver Workshop on State-Local-Federal Relationships in Socioeconomic Impact Assessment,
W79-04858 6B

SCHOOP, E. J.
Coastal Zone Plan Implementation,
W79-04709 6A

SCHROEDER, G. L.
Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

SCHUFLE, J. A.
Behavior of Water in Various States,
W79-04951 1A

SCHULTS, D. W.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

SCHUMANN, H. H.
Satellite Snow-Cover Observations in Arizona,
W79-04803 7B

SCHWAB, G. O.
Prediction of Deflection for Corrugated Plastic Tubing,
W79-04983 8G

Subsurface Drain Spacing from Water Table and Outflow Measurements,
W79-04986 4B

SCOTT, A. G.
Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. II. Preliminary Investigation of Cadmium-Binding Proteins,
W79-04969 5A

SEELE, G. D.
Mechanism of Electrode Demineralization,
W79-04672 3A

SELLERS, J.
A Viable Methodology to Implement the Principles and Standards,
W79-04692 6A

SEMENOV, V. P.
Reagent-Free Method of Effluent Neutralization (Bezreagentnyi sposob neitralizatsii stochnykh vod),
W79-04642 5D

SERDOBOL'SKII, E. N.
Electrochemical Coagulation of Industrial Effluents (Elektrokhimicheskaya koagulyatsiya promyshlennykh stokov),
W79-04630 5D

SESTRICH, D. E.
Reverse Osmosis Membranes Containing Graphitic Oxide,
W79-04665 3A

SHACKELFORD, J. M.
Recommended Procedures for the Testing and Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
W79-04944 3A

SHAPCHENKO, V. M.
Mechanism of Aluminum Sulfate Recovery from Lignin Sludge (Mekhanism izvlecheniya sulfat alyuminiya iz shlam-lignina),
W79-04643 5D

SHAPIRO, M.
Analyzing the Impact of Land Use on Sewer Service Area Planning,
W79-04701 6A

SHARPE, W. E.
Water-Conservation Methods to Meet Pennsylvania's Water Needs,
W79-04598 3D

SHARPLES, A.
New Synthetic Membranes for Reverse Osmosis Desalination,
W79-04520 3A

SHEEHAN, W. C.
Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II,
W79-04517 3A

SHEKHANOVA, I. A.
The Effect of Radioactive Pollution of Reservoirs on Fish,
W79-04543 5C

SHERWOOD, T. K.
Washing of Brine from Ice Crystals,
W79-04674 3A

SHI, S. F.
Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

SHIH, J. C. H.
Ultrafiltration: A Potential Method to Treat Poultry Processing Wastewater with Protein Recovered as the By-Product,
W79-04501 5D

SHIMAZAKI, T. T.
Development of Direct Contact Condensation Multistage Flash Distillation Process: Phase II,
W79-04521 3A

SHIMIZU, Y.
Paralytic Shellfish Toxins in the Sea Scallop, Placopecten Magellanicus, in the Bay of Fundy,
W79-04825 5A

SHULTZ, D. J.
Laboratory Studies of Gas Tracers for Reaeration,
W79-04712 5A

SIBERT, J. R.
Transport of Nutrients and Carbon from the Nanaimo River to its Estuary,
W79-04726 2L

SIEBERS, D.
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

SIEBURTH, J. M.
A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

SIEMER, E. G.
Nitrogen Sources for Hay Production on Flooded Meadows,
W79-04653 3F

SIMPSON, D. E.
Nutrient Budget for a Residential Stormwater Catchment in Durban, South Africa,
W79-04565 5B

SIMPSON, R. L.
The Relationship Between Aboveground and Belowground Biomass of Freshwater Tidal Wetland Macrophytes,
W79-04627 2I

SINDEN, J. A.
'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

SINGH, P. N.
Failure Criteria for Corrugated-Plastic Drain Tubing,
W79-04979 8G

SINGLEY, J. E.
Benefits and Costs of Water Quality Improvements,
W79-04699 6B

SINITSYNA, Z. A.
Estimation of Organochlorine Pesticide Loss in Surface Runoff Waters,
W79-04655 5B

SKAGGS, R. W.
Analysis of Combination Surface-Subsurface Drainage Systems for Humid Region Soils,
W79-04989 4B

Incorporating Crop Needs into Drainage System Design,
W79-04998 4B

Subsurface Drain Spacing from Water Table and Outflow Measurements,
W79-04986 4B

SKEA, W.
Products of Photosynthesis in Natural Populations of Marine Phytoplankton from the Gulf of Maine,
W79-04763 5C

SKELTON, J.
Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

SKJOLDAL, H. R.
The Spring Phytoplankton Bloom in Lindaspollene, A Landlocked Norwegian Fjord. II. Biomass and Activity of Net-and Nanoplankton,
W79-04784 5C

SKOWYRSKI, E.
Pilot-Plant Study of Two-Stage Chemical-Biological Purification of Pulping Effluents at the Ostroleka Pulp and Paper Mill (Badania poltechniczne nad oczyszczaniem sciekow celulozowych z Ostroleckich Zakladow Celulozowo-Papierniczych w Ukladzie Dwustopniowym Chemiczno-Biologicznym),
W79-04631 5D

SKRYABIN, G. K.
Cometabolism of Foreign Compounds,
W79-04658 5B

SLACK, D. C.
Rapid Determination of Soil Water Characteristic by Thermocouple Psychrometry,
W79-04987 2G

SLEIGH, J. H.
Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

SLOOFF, W.
Continuous Standard Water Delivery System for Bioassays with Aquatic Organisms,
W79-04770 5C

SMART, R. M.
The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

SMITH, G. M.
Design Concepts for In-Water Containment Structures for Marsh Habitat Development,
W79-04925 5E

SMITH, J. D.
Donnan Softening as a Pretreatment to Desalination Processes,
W79-04949 3A

SMITH, P.
Pollution of a Water Supply Catchment by Breeding Gulls and the Potential Environmental Health Implications,
W79-04843 5B

SMITH, R.
Effect of Salt Upon Hot-Water Dispersion in Well-Mixed Estuaries,
W79-04729 2L

SMITH, R. A.
Quality Considerations for Water Supply Evaluations,
W79-04714 6B

SMITH, R. L.
Application of the Frequency-Equivalent Non-Linear Hydrograph Method of Flood Frequency Analysis in Urban Basins,
W79-04788 2A

SMITH, S. B.
Lake Nematode Population Increase Following Bypass of Secondary Effluent,
W79-04818 5C

SNEDAKER, S. C.
Design of Simulation Models to Determine Biological Impact of Pollutants on the Marine Environment,
W79-04538 5C

SNOEYINK, V. L.
Reduction of Aqueous HOCl with Activated Carbon,
W79-04615 5F

SNYDER, N. W.
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

SOKOLOV, M. S.
General Laws of the Migration of Pesticide Residues in the Delta Landscape Under Irrigation,
W79-04919 5B

SOMERS, G. F.
The Role of Plant Residues in the Fate of Cadmium in Ecosystems. A Buffer Against Contamination of Water Sources,
W79-04584 5B

SONCINI-SESSA, R.
Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

SOULE, P. L.
Flood-Plain Delineation for Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch Basins, Fairfax County, Virginia,
W79-04801 2E

SPIERENBURG, T. B.
Continuous Standard Water Delivery System for Bioassays with Aquatic Organisms,
W79-04770 5C

SPIES, R. B.
The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

SPLINTER, W. E.
A Simplified Model of Corn Growth Under Moisture Stress,
W79-04607 2D

STEELE, T. D.
Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development,
W79-04808 6A

STEENHUIS, T. S.
Closed Form Solution for Pesticide Loss in Runoff Water,
W79-05000 5B

STEPHENS, D. W.
Laboratory Studies of Gas Tracers for Reaeration,
W79-04712 5A

STEPHENS, R.
Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

STEUERNAGEL, D. C.
Development of Procedures for Selecting and Designing Reusable Dredged Material Disposal Sites,
W79-04934 5E

STEVENS, J. B.
Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

STEWART, C. E.
Agriculture and Salinity,
W79-04659 5G

STOCKNER, J. G.
Phytoplankton Ecology of Vancouver Harbor,
W79-04617 5B

STOFFEL, K. L.
Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

STOFFYN, M.
Biological Control of Dissolved Aluminum in Seawater: Experimental Evidence,
W79-04824 5D

STRACK, O. D. L.
A New Function for Use in the Hodograph Method,
W79-04748 2F

STREEBIN, L. E.
Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

SUBRAMANYA, K.
Sluice Gates with High Discharge Coefficients,
W79-04572 8C

Uniformly Discharging Lateral Weirs,
W79-04573 8B

SUFFERN, J. S.
Temperature Influences on Growth of Aquatic Organisms,
W79-04851 5C

SUGAI, S.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

SUIDAN, M. T.
Reduction of Aqueous HOCl with Activated Carbon,
W79-04615 5F

SUKHATME, S. P.
Heat Transfer in the Liquid-Liquid Spray Tower,
W79-04670 3A

SUMAYAO, A.
Quantification of Rice Yield Benefits Attributable to Irrigation Water,
W79-04999 3F

SUNADA, D. K.
Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

SURATT, W. B.
Development of Direct Contact Condensation Multistage Flash Distillation Process: Phase II,
W79-04521 3A

SUTER, G. W. II.
Effects of Geothermal Energy Development of Fish and Wildlife,
W79-04508 5C

SUTHERLAND, R. C.
Simulation of Urban Non-Point Source Pollution,
W79-04609 5B

SWANSON, A.
Hard-Rock Wells get Mariposa Through the Drought,
W79-04579 3B

SWEENEY, H. A.
Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

SWENSON, W. A.
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

SZABO, M. F.
Environmental Assessment of Coal Transportation,
W79-04531 5C

SZARO, R. C.
No. 2 Fuel Oil Decreases Embryonic Survival of Great Black-Backed Gulls,
W79-04628 5C

SZOLLOSI-NAGY, A.
Application of On-line Prediction Techniques to Forecasting Short Term Agricultural Water Demand,
W79-04689 6D

TACKETT, K. M.
Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

TAI, D. Y.
Laboratory Studies of Gas Tracers for Reaeration,
W79-04712 5A

TAITZ, H.
Ammonia Toxicity and pH Control in Fish Toxicity Bioassays of Treated Wastewaters,
W79-04817 5C

TAKASHIMA, F.
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

TALAVAGE, J. J.
Planning Storm-Drainage Systems for Urban Growth,
W79-04618 6F

TANISTRA, I.
Application of Reverse Osmosis and Ultrafiltration to Purification of Pulp and Paper Industry Effluents. VI. Purification of Pulp Bleaching Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego),
W79-04632 5D

TARASOV, M. N.
Hexachlorocyclohexane, Metaphos, and Chlorophos Decomposition in Soil and Their Migration with the Waters of Surface Runoff,
W79-04654 5B

TAYLOR, H. D.
Occurrence, Quantity, and Quality of Ground Water in Taylor County, Texas.
W79-04575 2F

TCHOBANOGLOUS, G.
Chronic Exposure of Channel Catfish, Ictalurus Punctatus, to Ammonia: Effects on Growth and Survival,
W79-04835 5C

TELKES, M.
Research on Methods for Solar Distillation,
W79-04513 3A

TEMPLER, O. W.
An Analysis of Playa Lake Water Utilization on the Texas High Plains,
W79-04611 6E

Problems of Public Access to Water in Texas Lakes and Streams: An Analysis,
W79-04555 6E

TERMAN, G. L.
Nutrient Effectiveness in Relation to Rates Applied for Pot Experiments: I. Nitrogen and Potassium,
W79-04992 2G

Nutrient Effectiveness in Relation to Rates Applied for Pot Experiments: II. Phosphorus Sources,
W79-04993 2G

THEIS, T. L.
Phosphate Removal Using Waste Calcium Sulfate,
W79-04977 5D

THOMAS, D. L.
Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

THOMAS, R. R.
Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

THOMPSON, G.
New Synthetic Membranes for Reverse Osmosis Desalination,
W79-04520 3A

THOMPSON, K. W.
A Computer Monitored Aquatic Bioassay System,
W79-04652 5A

THOMPSON, T. L.
Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

THOMSON, G. D.
A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

THUM, A. B.
Comparison of a High Volume Pump and Conventional Plankton Nets for Collecting Fish Larvae Entrained in Power Plant Cooling Systems,
W79-04703 5A

TIGNOL, A. P. N.
Process for the Sequestration of Oxygen Dissolved in Water and Compositions Useful for Such Purpose,
W79-04884 5F

TITUS, M. F.
Irregular Wave Runup and Overtopping,
W79-04814 2H

TIWARI, D. N.
UV-Induced Developmental Abnormalities in the Filamentous Blue-Green Alga Nostoc Linckia,
W79-04779 5C

TOEBES, G. H.
Reservoir System Operating Policy--Case Study,
W79-04616 6A

TOKIN, I. B.
Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

TOWNSEND, C. R.
Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

TOWNSEND, F. M.
Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

TREGUBENKO, M. YA.
Physiological Reaction of Different Corn Hybrids to Drought (In Russian),
W79-04708 3F

TRUBY, R. L.
Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

TRUE, G.
Subsurface Drainage Systems Installations in Arid Lands--The State of the Art,
W79-04907 5G

TRUNOVA, O. N.
Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

TSAI, C-F.
Tuberculation of Pearl Dace, Semotilus Margarita (Pisces: Cyprinidae),
W79-04663 6G

TSAI, Y. H.
Temporal Moments for Longitudinal Dispersion,
W79-04732 5B

TSCHESCHKE, P.
Management for Minimizing Nitrogen Leaching Losses on Irrigated Sandy Soils,
W79-04980 3F

TUCKER, C. S.
Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

TURNER, J. H.
Improvement of the Steady Floating Random Walk Monte Carlo Method Near Straight Line and Circular Boundaries with Application to Groundwater Flow,
W79-04557 2F

UDEH, C. N.
Optimal Irrigation Management Strategy Under Hydrologic and Irrigation Efficiency Uncertainty Regimes,
W79-04685 3F

ULASKA, Z.
Pilot-Plant Study of Two-Stage Chemical-Biological Purification of Pulping Effluents at the Ostroleka Pulp and Paper Mill (Badania poltechniczne nad oczyszczaniem sciekow celulozowych z Ostroleckich Zakladow Celulozowo-Papierniczych w Ukladzie Dwustopniowym Chemiczno-Biologicznym),
W79-04631 5D

UNDAN, R. C.
Drainage Requirements for Lowland Rice,
W79-04908 5G

UZZELL, J. C. JR.
Three-Dimensional Temperature Model for Shallow Lakes,
W79-04731 5B

VALLETTE, P.
Papermaking Primary Sludges. Dewatering Studies Realized with Different Industrial Devices (Boues primaires de papeterie. Essais de deshydratation realises avec differents appareils industriels),
W79-04581 5D

VAN DER SCHALIA, W. H.
A Computer Monitored Aquatic Bioassay System,
W79-04652 5A

VAN SCHILFGAARDE, J.
Environmental and Institutional Aspects of Irrigation Agriculture,
W79-04978 3F

VANDEGRIFT, A. E.
The Mechanism of Mass Transfer Through a Liquid Interface,
W79-04666 3A

VELINSKY, J.
Criteria for Selecting Installations for Fiber Recovery (Auswahlkriterien fuer Anlagen zur Faserrueckgewinnung),
W79-04633 5D

VENUGOPALAN, M.
Behavior of Water in Various States,
W79-04951 1A

VERWORN, H. R.
Determining Nutrient Loading from Rainfall and Runoff in Small Rivers,
W79-04566 5B

VINCENT, A. L.
Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

VINOGRADOV, M. Y.
Problems of Modeling the Effect of Pollution on Biological Systems of the Ocean,
W79-04539 5C

VIRCHENKO, E. P.
Estimation of Organochlorine Pesticide Loss in Surface Runoff Waters,
W79-04655 5B

VISHNEVSKII, N. V.
Physiological Reaction of Different Corn Hybrids to Drought (In Russian),
W79-04708 3F

VITTETOE, G. C.
Field Evaluations of Groundwater Control by Trench and Trenchless Methods of Installed Drains--Lower Rio Grande Valley of Texas,
W79-04906 4B

VOLKOV, A. I.
Dewatering of High-Ash Sediments of Effluents (Obezvozhivamie vysokozolinykh osadkov stochnykh vod),
W79-04644 5D

VOLPI, G.
On the Use of a Main Trend for the Kriging Technique in Hydrology,
W79-04870 2F

VOS, K. D.
Reverse Osmosis for Water Desalination,
W79-04516 3A

WAGENET, R. J.
An Erosion Model for Arid Wildland Watersheds,
W79-04994 2J

WAGNER, G. H.
Trace Elements in the Sediments of the Buffalo River, Arkansas,
W79-04956 5A

WAGNER, K. D.
Legal Problems in Changing Uses or Coordinating Uses of Keyhole Reservoir,
W79-04595 6E

WAKEFORD, A. C.
Enhancement of Water-Quality Monitoring Systems by Incorporating Water-Quality Modelling and Time-Series Analysis,
W79-04571 5B

A Mathematical Deterministic River-Quality Model. Part I: Formulation and Description,
W79-04721 5B

WALDEN, C. C.
Research on Pulp and Paper Industry Water and Effluent Quality Problems -- A Review,
W79-04668 5C

WALKER, M. E.
Calcium-Supplying Characteristics of Two Gypsum Materials on Southeastern Coastal Plain Soils,
W79-04662 2G

WALKER, P. N.
Failure Criteria for Corrugated-Plastic Drain Tubing,
W79-04979 8G

WALLIS, J. R.
The Arno River Flood Study (1971-1976),
W79-04725 2E

WALTER, M. F.
Closed Form Solution for Pesticide Loss in Runoff Water,
W79-05000 5B

WARD, C. H.
Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

WARRICK, A. W.
Time-Dependent Solutions to the One-Dimensional Linearized Moisture Flow Equation with Water Extraction,
W79-04602 2G

WASLENCHUK, D. G.
Factors Controlling the Estuarine Chemistry of Arsenic,
W79-04728 2L

WATSON, D. C.
Pollution of a Water Supply Catchment by Breeding Gulls and the Potential Environmental Health Implications,
W79-04843 5B

WATTS, D.
Management for Minimizing Nitrogen Leaching Losses on Irrigated Sandy Soils,
W79-04980 3F

WEBB, J. W.
Habitat Development Field Investigations, Bolivar Peninsula Marsh and Upland Habitat Development Site, Galveston Bay, Texas; Appendix D: Propagation of Vascular Plants and Post-Propagation Monitoring of Botanical, Soil, Aquatic Biota, and Wildlife Resources,
W79-04927 5E

WEBER, J.
Preliminary Assessment of Policy and Management Options for Groundwater Mining in the Great Plains,
W79-04957 4B

WEBER, W. J. JR.
Predictive Model for Design of Fixed-Bed Adsorbers: Parameter Estimation and Model Development,
W79-04704 5D

WEIGER, C.
Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

WEINGERGER, A. J.
By-Products from Saline Water Conversion Plants: A Feasibility Study,
W79-04946 3A

WELLS, D. K.
Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

WELSH, R. P.
Lead Accumulation in Plankton Blooms from Ullswater, The English Lake District,
W79-04819 5C

WENDT, C. W.
Use of Methanol-Water Solutions for Freeze Protection of Tensiometers,
W79-04605 3F

WESNER, G. M.
Energy for Production of Consumable Materials,
W79-04713 5D

WESTFALL, D. E.
Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

WETCH, J. R.
Development of Direct Contact Condensation Multistage Flash Distillation Process: Phase II,
W79-04521 3A

WHEATCRAFT, S. W.
Waste Injection into a Two-Phase Flow Field: Sand-Box and Hele-Shaw Models Study,
W79-04599 5E

WHEATON, R. Z.
Application of Land Treatment for Water Quality Improvement,
W79-04905 5G

WHIGHAM, D. F.
The Relationship Between Aboveground and Belowground Biomass of Freshwater Tidal Wetland Macrophytes,
W79-04627 2I

WHITE, F.
Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

WHITE, W. P.
Washing of Brine from Ice Crystals,
W79-04674 3A

WHITFIELD, M.
The Hydrolysis of Ammonium Ions in Sea Water-Experimental Confirmation of Predicted Constants at One Atmosphere Pressure,
W79-04844 5A

WHITMAN, R. F.
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

WIDSTRAND, C.
Social and Economic Aspects of Water Exploitation,
W79-04760 6B

WIEBE, P. H.
Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

WILKE, O. C.
Use of Methanol-Water Solutions for Freeze Protection of Tensiometers,
W79-04605 3F

WILLIAMS, C. S.
Water-Quality Investigation of the Yellville Watershed, Arkansas,
W79-04802 7C

WILLIAMS, D. F.
Postimpoundment Survey of Water-Quality Characteristics of Raystown Lake, Huntington and Bedford Counties, Pennsylvania,
W79-04806 2H

WILLIAMS, D. G.
Speculative Policy Making in the Environmental Arena,
W79-04613 6E

WILLIAMS, J. A.
Waste Injection into a Two-Phase Flow Field: Sand-Box and Hele-Shaw Models Study,
W79-04599 5E

WILLIAMS, T. H.
Estimating Evapotranspiration Rates for Corn in Delaware,
W79-04988 2D

WILLIAMSON, K. J.
Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

WILSON, E. M.
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

WILSON, L. P. S.
Water Purification by Reverse Osmosis,
W79-04887 3A

WINDOM, H. L.
Factors Controlling the Estuarine Chemistry of Arsenic,
W79-04728 2L

WINN, C. B.
The Application of Optimal Linear Regulator Theory to a Problem in Water Pollution,
W79-04596 7B

WIRTH, T. L.
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

WITHERSPOON, P. A.
Numerical Model for Saturated-Unsaturated Flow in Deformable Porous Media. 3. Applications,
W79-04749 2G

WOLCOTT, A. R.
Nitrate and Phosphorus Runoff Losses from Small Watersheds in Great Lakes Basin,
W79-04535 5C

WOLLER, D. M.
Public Groundwater Supplies in Warren County,
W79-04720 7C

WOLVERTON, B. C.
Upgrading Faculative Wastewater Lagoons with Vascular Aquatic Plants,
W79-04830 5D

WONG, A.
The Impact of Turpentine Recovery on the Toxicity and BOD of Kraft Mill Effluents,
W79-04534 5C

WONG-CHONG, G. M.
Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

WOOD, E. F.
Applying Multiattribute Utility Theory to Evaluation of Tisza River Basin Development Plans,
W79-04688 6A

WORSTELL, J. R.
Effects of Availability of Water on Irrigation Systems Operations,
W79-04683 3F

WRENN, W. B.
Browns Ferry Biotnermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

WRIGHT, D. A.
Cadmium Turnover in the Shore Crab Carcinus Maenas,
W79-04973 5B

YAMAGUCHI, M.
Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

YASUI, T.
Effect of Enrichment with Digested Night Soil on the Growth of Marine Plankton (In Japanese),
W79-04626 5B

YASUMOTO, T.
Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

YEN, T. F.
Purifying Oil Shale Retort Water,
W79-04883 5D

YOUNG, J. L.
Photosynthesis, Transpiration, and Leaf Elongation in Corn Seedlings at Suboptimal Soil Temperatures,
W79-04608 2I

YOUNG, R. J.
Urban Runoff from a Road Surface--A Water Quality Study,
W79-04567 5B

YU, J. K.
The Development of a Combined Water Quality Index,
W79-04610 6B

YU, N-T
Behavior of Water in Various States,
W79-04951 1A

ZANELLA, E. F.
Biosolids as Food,
W79-04638 5C

ZHDAMIROV, G. G.
Certain Laws of Organochlorine Pesticide Redistribution in the Soil-Water, Soil-Plant System,
W79-04921 5B

ZHOLONDZ', V. A.
Morphometry of a Tidal Mouth, According to its Discrete Model,
W79-04950 2L

ZIELINSKI, J.
Pilot-Plant Study of Two-Stage Chemical-Biological Purification of Pulping Effluents at the Ostroleka Pulp and Paper Mill (Badania poltechniczne nad oczyszczaniem sciekow celulozowych z Ostroleckich Zakladow Celulozowo-Papierniczych w Ukladzie Dwustopniowym Chemiczno-Biologicznym),
W79-04631 5D

ZIMMER, D. W.
Channelization and Invertebrate in Some Iowa Streams,
W79-04789 2E

ZNOTINAS, N. M.
Comparison of Alternative Engineering Designs,
W79-04690 6A

ZOBRIST, J.
The Interrelationships Among Chemical Parameters in Rivers--Analysing the Effect of Natural and Anthropogenic Sources,
W79-04569 5B

ZWALLY, H. J.
Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

ZWICKLER, S.
Use of Waste Heat for Production of Fresh Water,
W79-04676 3A

ORGANIZATIONAL INDEX

ABCOR INC., WILMINGTON, MA. WALDEN DIV.
Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater,
W79-04525 6B

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, AVONDALE, PA. STROUD WATER RESEARCH CENTER.
A Comparison of Methods for Measuring Primary Productivity and Community Respiration in Streams,
W79-04775 5C

ACRES AMERICAN INC., BUFFALO, NY.
Development of Procedures for Selecting and Designing Reusable Dredged Material Disposal Sites,
W79-04934 5E

ADELAIDE UNIV. (AUSTRALIA). DEPT. OF ZOOLOGY.
Cyclomorphosis in Daphnia Carinata King (Crustacea: Cladocera) from Two Adjacent Sewage Lagoons in South Australia,
W79-04821 5C

ADVANCED DRAINAGE SYSTEMS, INC., COLUMBUS, OH.
Trenchless Drainage,
W79-04912 8A

ADVANCED DRAINAGE SYSTEMS, INC., FRESNO, CA. DEPT. OF AGRICULTURAL ENGINEERING.
Subsurface Drainage Systems Installations in Arid Lands--The State of the Art,
W79-04907 5G

AEROJET-GENERAL CORP., AZUSA, CA.
Structure and Properties of Reverse Osmosis Membranes,
W79-04664 3A

A Study of Membranes for Desalination by Reverse Osmosis,
W79-04675 3A

AGRICULTURAL RESEARCH ORGANIZATION, DOR (ISRAEL). FISH AND AQUACULTURE STATION.
Autotrophic and Heterotrophic Production of Microorganisms in Intensely-Manured Fish Ponds, and Related Fish Yields,
W79-04831 5C

AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. PESTICIDE DEGRADATION LAB.
Pesticide Transport and Metabolism in Model Systems,
W79-04661 5B

AGRICULTURAL RESEARCH SERVICE, BIG SPRING, TX.
Parallel Terraces on Flat Slopes,
W79-04915 4A

AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CA. SALINITY LAB.
Minimizing Salt in Return Flow Through Irrigation Management.
W79-04996 3F

AHMADU BELLO UNIV., ZARIA (NIGERIA). DEPT. OF PHYSICS.
The Computational Efficiency and Taylor Expansion Derivation of Approximating Equations to the Groundwater Flow Equation,
W79-04737 2F

AKADEMIYA NAUK SSSR, MOSCOW. INST. OF PLANT PHYSIOLOGY.
Water Absorption by Plants in a Dry Wind and Under Periodic Spraying with Water (In Russian),
W79-04707 3F

AKADEMIYA NAUK SSSR, MOSCOW. INST. OKEANOLOGII.
Problems of Modeling the Effect of Pollution on Biological Systems of the Ocean,
W79-04539 5C

AKADEMIYA NAUK SSSR, PUSHCHINO. INST. OF AGROCHEMISTRY AND SOIL SCIENCES.
General Laws of the Migration of Pesticide Residues in the Delta Landscape Under Irrigation,
W79-04919 5B

AKADEMIYA NAUK SSSR, PUSHCHINO. INST. OF BIOCHEMISTRY AND PHYSIOLOGY OF MICROORGANISMS.
Cometabolism of Foreign Compounds,
W79-04658 5B

AKADEMIYA NAUK SSSR, UFA. INST. OF BIOLOGY.
Changes in Biochemical Characteristics of Chernozem Soils in the Region of the Western Slope of the Ural Mountains During Irrigation,
W79-04706 2G

ALASKA UNIV., FAIRBANKS. ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER.
Analysis of Alaska's Water Use Act and Its Interaction with Federal Reserved Water Rights,
W79-04959 6E

ALL-UNION RESEARCH INST. OF MARINE FISHERIES AND OCEANOGRAPHY, MOSCOW (USSR).
The Effect of Radioactive Pollution of Reservoirs on Fish,
W79-04543 5C

AMERICAN CYANAMID CO., STAMFORD, CT.
By-Products from Saline Water Conversion Plants: A Feasibility Study,
W79-04946 3A

AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK. TASK COMMITTEE ON AGRICULTURAL RUNOFF AND DRAINAGE OF THE WATER QUALITY.
Quality Aspects of Agricultural Runoff and Drainage.
W79-04710 5B

AMERICAN STANDARD, INC., NEW BRUNSWICK, NJ.
Reverse Osmosis Membrane Regeneration,
W79-04954 3A

ANGLIAN WATER AUTHORITY (ENGLAND). PUBLIC HEALTH AND WATER SUPPLIES.
Nitrates in Water Supply Abstractions in the Anglian Region: Current Trends and Remedies under Investigation,
W79-04570 5A

ARGONNE NATIONAL LAB., IL.
A Biologist's Manual for the Evaluation of Impacts of Coal-Fired Power Plants on Fish, Wildlife, and Their Habitats,
W79-04509 5C

ARIZONA STATE UNIV., TEMPE. DEPT. OF ZOOLOGY.
Acute Toxicity of Copper, Zinc and Manganese in Single and Mixed Salt Solutions to Juvenile Longfin Dace, Agosia Chrysogaster,
W79-04833 5C

ARIZONA UNIV., TUCSON. DEPT. OF MATHEMATICS.
Time-Dependent Solutions to the One-Dimensional Linearized Moisture Flow Equation with Water Extraction,
W79-04602 2G

ARIZONA UNIV., TUCSON. SCHOOL OF RENEWABLE NATURAL RESOURCES.
The Development of a Combined Water Quality Index,
W79-04610 6B

ARKANSAS UNIV., FAYETTEVILLE.
Trace Elements in the Sediments of the Buffalo River, Arkansas,
W79-04956 5A

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF CHEMISTRY.
Hydrolytic and Photochemical Degradation of Organophosphorus Pesticides,
W79-04682 5B

ARMY CONCEPTS ANALYSIS AGENCY. BETHESDA, MD.
A Model for Determining the Impact of Control Costs on Municipal Finances,
W79-04698 6C

ARMY ENGINEER DISTRICT, ALBUQUERQUE, NM.
Flood Plain Information: Salt Creek - Vicinity of Pueblo, Colorado.
W79-04865 2E

ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
Flood Plain Information: Tchefuncta River and Tributaries, Covington, LA.
W79-04855 2E

Flood Plain Information: Calcasieu River, Oakdale, Louisiana,
W79-04861 2E

Special Flood Hazard Information: Franklin, Louisiana and Vicinity, Yokely Bayou and Bayou Teche.
W79-04864 2E

ARMY ENGINEER DISTRICT, OMAHA, NE.
Flood Plain Information: Big Thompson River, Weld County, Colorado,
W79-04854 2E

ARMY ENGINEER DISTRICT, ST. LOUIS, MO.
A Proposed Method of Evaluating Flood Damages to Historic Homes--An Externality Approach,
W79-04702 6B

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.
The Growth and Biomass Distribution of Two Emergent Freshwater Plants, Cyperus Esculentus and Scirpus Validus, on Different Sediments,
W79-04838 5C

Walnut Creek Channel Improvement Project, Contra Costa County, California; Hydraulic Model Investigation,
W79-04923 2E

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.

Needs and Areas of Potential Application of Disposal Area Reuse Management (DARM),
W79-04930 5E

Proceedings, Research Planning Conference on the Aquatic Plant Control Program, 3-7 October 1977.
W79-04932 4A

ARTHUR D. LITTLE RESEARCH INST., INVERESK (SCOTLAND).
New Synthetic Membranes for Reverse Osmosis Desalination,
W79-04520 3A

ASAHI KASEI KOGYO KABUSHIKI KAISHA, OSAKA (JAPAN). (ASSIGNEE).
Ion Exchange Process,
W79-04895 5D

ATOMICS INTERNATIONAL DIV., CANAGO PARK, CA.
Development of Direct Contact Condensation Multistage Flash Distillation Process: Phase II,
W79-04521 3A

AUBURN UNIV., AL. DEPT. OF FISHERIES AND ALLIED AQUACULTURES.
Effects of Simazine Treatment on Channel Catfish and Bluegill Production in Ponds,
W79-04827 5C

BADGER CO., INC., CAMBRIDGE, MA.
Research Continuation of Badger-Hickman Centrifugal Distillation Testing on Unit Number 4.
W79-04955 3A

BAGHDAD UNIV. (IRAQ). DEPT. OF BIOLOGY.
Annual Cycles of Some Cladocerans in a Polluted Stream,
W79-04820 5C

BANARAS HINDU UNIV. (INDIA). DEPT. OF BOTANY.
UV-Induced Developmental Abnormalities in the Filamentous Blue-Green Alga Nostoc Linckia,
W79-04779 5C

BANYASZATI KUTATO INTEZET, BUDAPEST (HUNGARY).
Input for a Stochastic Control Model of P Loading,
W79-04623 5B

BARI UNIV. (ITALY). INST. OF BOTANY.
Research on Ascorbic Acid Physiology in Red Algae. IV. On the Seasonal Variation of AA/DHA Ratio in Pterocladia Capillacea (GMEL.) Born. et Thur. (Rhodophyta, Gelidiales).
W79-04782 5C

BATTELLE MEMORIAL INST. COLUMBUS, OH.
Final Three Years' Progress on Study and Field Evaluation of Sea Water Stills.
W79-04512 3A

Second Two Years' Progress on Study and Field Evaluation of Solar Sea-Water Stills.
W79-04514 3A

The Zone-Purification Process as a Method of Preparation of Potable Water from Sea Water,
W79-04936 3A

BECHTEL, INC., SAN FRANCISCO, CA.
Optimal Sequence of Incremental Precipitation,
W79-04901 2A

BERGEN UNIV. (NORWAY). INST. OF MARINE BIOLOGY.
The Spring Phytoplankton Bloom in Lindaspollene, A Landlocked Norwegian Fjord. II. Biomass and Activity of Net-and Nanoplankton,
W79-04784 5C

BHABHA ATOMIC RESEARCH CENTRE, BOMBAY (INDIA). HEALTH PHYSICS DIV.
Flux of Certain Radionuclides in the Blood-Clam Anadara Granosa Linneaus under Environmental Conditions,
W79-04849 5A

BIGELOW LAB. FOR OCEAN SCIENCE, WEST BOOTHBAY HARBOR, ME.
Products of Photosynthesis in Natural Populations of Marine Phytoplankton from the Gulf of Maine,
W79-04763 5C

BIOLOGISCHE ANSTALT HELGOLAND, HAMBURG (GERMANY, F.R.).
Heavy Metal Action on Transintegumentary Absorption of Glycine in Two Annelid Species,
W79-04974 5C

BRISTOL UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
Toward More Detailed Field Monitoring of Variable Source Areas,
W79-04739 2G

BRISTOL UNIV. (ENGLAND). RESEARCH UNIT FOR COMPARATIVE ANIMAL RESPIRATION.
Zinc Content of the Gills of Rainbow Trout (S. Gairdneri) after Treatment with Zinc Solutions under Normoxic and Hypoxic Conditions,
W79-04836 5C

BRITISH COLUMBIA RESEARCH COUNCIL, VANCOUVER.
Research on Pulp and Paper Industry Water and Effluent Quality Problems -- A Review,
W79-04668 5C

BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF SOIL SCIENCE.
Hydrologic Behavior of a Forested Mountain Soil in Coastal British Columbia,
W79-04564 2G

BUREAU OF OUTDOOR RECREATION, PHILADELPHIA, PA. NORTHEAST REGIONAL OFFICE.
Water-Oriented Outdoor Recreation in the Illinois River Basin (Appendix VI)--Illinois-Indiana-Wisconsin.
W79-04853 6B

BUREAU OF RECLAMATION, DENVER, CO. ENGINEERING AND RESEARCH CENTER.
Ion-Exchange Pretreatment of Water After Resin Regeneration with Reverse Osmosis Reject Brine,
W79-04505 5F

Limnological Aspects of Lake Mead, Nevada-Arizona,
W79-04506 2H

BURNS AND ROE, INC., NEW YORK.
Saline Water Conversion Demonstration Plant, Point Loma I, San Diego, California: Second Annual Report.
W79-04943 3A

BURNS AND ROE, INC., ORADELL, NJ.
Use of Waste Heat for Production of Fresh Water,
W79-04676 3A

CALIFORNIA COASTAL COMMISSION, SAN FRANCISCO.
Coastal Zone Plan Implementation,
W79-04709 6A

CALIFORNIA DEPT. OF WATER RESOURCES, SACRAMENTO.
Hard-Rock Wells get Mariposa Through the Drought,
W79-04579 3B

CALIFORNIA STATE COLL., STANISLAUS, TURLOCK. DEPT. OF CHEMISTRY.
The Effect of Recreation on Water Quality,
W79-04963 5B

CALIFORNIA UNIV., BERKELEY. DEPT. OF FORESTRY AND CONSERVATION.
Institutional Change and Fire Management,
W79-04966 6E

CALIFORNIA UNIV., BERKELEY. DIV. OF ENTOMOLOGY AND PARASITOLOGY.
An Evaluation of the Effects of Geothermal Energy Development on Aquatic Biota in the Geysers Area of California,
W79-04962 6G

CALIFORNIA UNIV., BERKELEY. GRADUATE SCHOOL OF PUBLIC POLICY.
Water Banking: How to Stop Wasting Agricultural Water,
W79-04875 3F

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Numerical Model for Saturated-Unsaturated Flow in Deformable Porous Media. 3. Applications,
W79-04749 2G

CALIFORNIA UNIV., BODEGA BAY. BODEGA MARINE LAB.
Ammonia Production Rates of Artemia Salina Under Various Culture Conditions,
W79-04971 5B

CALIFORNIA UNIV., DAVIS. DEPT. OF CIVIL ENGINEERING.
Chronic Exposure of Channel Catfish, Ictalurus Punctatus, to Ammonia: Effects on Growth and Survival,
W79-04835 5C

CALIFORNIA UNIV., IRVINE.
Environmental Quality Research. Use of Unicellular Algae for Evaluation of Potential Aquatic Contaminants. Second Annual Report,
W79-04850 5A

CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
The Infaunal Benthos of a Natural Oil Seep in the Santa Barbara Channel,
W79-04624 5B

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCES.
The Effect of Salt Precipitation and High Sodium Concentrations on Soil Hydraulic Conductivity and Water Retention,
W79-04650 2G

CALIFORNIA UNIV., SANTA BARBARA. DEPT. OF POLITICAL SCIENCE.
Water Policy and Decision-Making in the Colorado River Basin.
W79-04868 6E

CAMBRIDGE UNIV. (ENGLAND). DEPT. OF APPLIED MATHEMATICS AND THEORETICAL PHYSICS.
Effect of Salt Upon Hot-Water Dispersion in Well-Mixed Estuaries,
W79-04729 2L

CARNEGIE-MELLON INST. OF RESEARCH, PITTSBURGH, PA.
Evaluation of EPA Recommended Treatment and Control Technology for Blast Furnace Wastewater,
W79-04705 5D

CASTLE AND COOKE, INC. (HONDURAS).
Incorporating Crop Needs into Drainage System Design,
W79-04998 4B

CENTRO DI RICERCA IBM DI PISA (ITALY).
The Arno River Flood Study (1971-1976),
W79-04725 2E

CH2M/HILL, REDDING, CA.
Simulation of Urban Non-Point Source Pollution,
W79-04609 5B

CHALMERS UNIV. OF TECHNOLOGY, GOTEBORG (SWEDEN). DEPT. OF WATER SUPPLY AND SEWERAGE.
Atmospheric Fallout and Street Cleaning-Effects on Urban Storm Water and Snow,
W79-04568 5B

CIBA-GEIGY LTD., LONDON (ENGLAND). (ASSIGNEE).
Treatment of Water,
W79-04885 5F

CITY COLL., NEW YORK. DEPT. OF BIOLOGY.
Effects of Lead on Growth of the Marine Diatom Skeletonema Costatum,
W79-04600 5C

COASTAL ENGINEERING RESEARCH CENTER, FORT BELVOIR, VA.
Sedimentation in a 'Half-Tide' Harbor, Part 1. Sedimentation under Ice-Free Conditions,
W79-04562 2J

Sedimentation in a 'Half-Tide' Harbor, Part 2. Sedimentation During Periods of Ice-Cover,
W79-04563 2J

Irregular Wave Runup and Overtopping,
W79-04814 2H

Design Concepts for In-Water Containment Structures for Marsh Habitat Development,
W79-04925 5E

COLOGNE UNIV. (GERMANY, F.R.). BOTANISCHES INST.
Studies on 14CO2-Assimilation in Marine Rhodophyceae,
W79-04766 5C

COLORADO STATE UNIV., FORT COLLINS.
Institutional Arrangements for Effective Water Management in Colorado,
W79-04503 6E

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND CHEMICAL ENGINEERING.
Allocation Procedure of Water and Land Resources in Relation to Some Irrigation Quality Parameters,
W79-04700 6A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRONOMY.
Nitrogen Sources for Hay Production on Flooded Meadows,
W79-04653 3F

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Generalized Stability Analysis of Channel Banks,
W79-04574 8D

An Analysis of Drought Research Needs for Colorado Agriculture,
W79-04964 3B

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF MECHANICAL ENGINEERING.
The Application of Optimal Linear Regulator Theory to a Problem in Water Pollution,
W79-04596 7B

COLORADO STATE UNIV., FORT COLLINS. ENGINEERING RESEARCH CENTER.
Growth of Groundwater Mounds Affected by In-Transit Water,
W79-04743 2F

COLORADO UNIV., BOULDER. DEPT. OF ECONOMICS.
Economic Issues Related to Large-Scale Water Transfers in the USA,
W79-04759 6D

COLORADO UNIV., BOULDER, DEPT. OF ENVIRONMENTAL POPULATION AND ORGANISMIC BIOLOGY.
Sampling and Chemical Interpretation of Precipitation for Mass Balance Studies,
W79-04747 2B

CONCORDIA UNIV., MONTREAL (QUEBEC). DEPT. OF CIVIL ENGINEERING.
Sluice Gates with High Discharge Coefficients,
W79-04572 8C

Uniformly Discharging Lateral Weirs,
W79-04573 8B

CONNECTICUT UNIV., STORRS. DEPT. OF GEOLOGY AND GEOPHYSICS.
On the Detection of Shallow Aquifers Using Thermal Infrared Imagery,
W79-04745 7B

CONSAD RESEARCH CORP., PITTSBURGH, PA.
Methodology for Designing Cost-Effective Monitoring and Compliance Strategies for Pesticide Use,
W79-04524 6A

CORNELL UNIV., ITHACA, NY.
Public Perceptions of Issues and Problems in the Lake Champlain Basin Area, A Summary,
W79-04558 2H

CORNELL UNIV., ITHACA, NY. DEPT. OF AGRICULTURAL ECONOMICS.
Oil Spills: The Strategy of Recovery,
W79-04904 5C

CORNELL UNIV., ITHACA, NY. DEPT. OF AGRICULTURAL ENGINEERING.
Closed Form Solution for Pesticide Loss in Runoff Water,
W79-05000 5B

CORNELL UNIV., ITHACA, NY. DEPT. OF NATURAL RESOURCES.
Phosphorus Loadings to Lakes and Some of Their Responses. Part 1. A New Calculation of Phosphorus Loading and Its Application to 13 New York Lakes,
W79-04621 5B

Phosphorus Loadings to Lakes and Some of Their Responses. Part 2. Regression Models of Summer Phytoplankton Standing Crops, Winter Total P, and Transparency of New York Lakes with Known Phosphorus Loadings,
W79-04622 5B

Lake Nematode Population Increase Following Bypass of Secondary Effluent,
W79-04818 5C

CORNELL UNIV., ITHACA, NY. SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING.
A Nonlinear Analysis of the Relationship Between Rainfall and Runoff for Extreme Floods,
W79-04604 2A

CORNELL UNIV., ITHACA, NY. SECTION OF ECOLOGY AND SYSTEMATICS.
Nitrogen-Fixation in the Littoral Benthos of an Oligotrophic Lake,
W79-04776 5C

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR. MARINE AND FRESHWATER ECOLOGY BRANCH.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay, Vol. I, Feb - June 1976,
W79-04928 5C

CULP, WESNER, CULP, SANTA ANA, CA.
Estimating Costs for Water Treatment as a Function of Size and Treatment Plant Efficiency,
W79-04527 6B

Energy for Production of Consumable Materials,
W79-04713 5D

DALHOUSIE UNIV., HALIFAX (NOVA SCOTIA). DEPT. OF OCEANOGRAPHY.
Kinetic Analysis of Interactive Effects of Cadmium and Nitrate on Growth of Thalassiosira Fluviatilis (Bacillariophyceae),
W79-04587 5A

DAMES AND MOORE, DENVER, CO.
Construction Costs for Municipal Wastewater Conveyance Systems: 1973-1977.
W79-04761 6B

DELAWARE UNIV., LEWES. MARINE STUDIES COMPLEX.
Vertical Migration of Benthos in Simulated Dredged Material Overburdens; Vol. I: Marine Benthos,
W79-04931 5E

DELAWARE UNIV., NEWARK. DEPT. OF AGRICULTURAL ENGINEERING.
Estimating Evapotranspiration Rates for Corn in Delaware,
W79-04988 2D

DELAWARE UNIV., NEWARK. SCHOOL OF LIFE AND HEALTH SCIENCES.
The Role of Plant Residues in the Fate of Cadmium in Ecosystems. A Buffer Against Contamination of Water Sources,
W79-04584 5B

DENVER RESEARCH INST., CO. INDUSTRIAL ECONOMICS DIV.
Report of the Denver Workshop on State-Local-Federal Relationships in Socioeconomic Impact Assessment,
W79-04858 6B

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, LOWER HUTT (NEW ZEALAND). SOIL BUREAU.
Phosphorus and Nitrate Run-Off in Hill Pasture and Forest Catchments, Taita, New Zealand,
W79-04774 5C

DEPARTMENT OF THE ARMY, WASHINGTON, DC.
Method for Detecting Water Pollutants,
W79-04897 5A

DORR-OLIVER, INC., STAMFORD, CT.
Development of a Thin-Liquid-Film Membrane Unit for Desalination by Reverse Osmosis,
W79-04515 3A

DOUGLAS AIRCRAFT CO., INC., NEWPORT BEACH, CA. ASTROPOWER LAB.
Investigation of Inorganic Ion Exchange Membranes for Electrodialysis Application,
W79-04942 3A

DUPONT DE NEMOURS (E.I.) AND CO., AIKEN, SC. SAVANNAH RIVER LAB.
Impingement and Entrainment of Fishes at the Savannah River Plant and NPDES 316b Demonstration,
W79-04879 5B

The Distribution and Abundance of Submerged Aquatic Macrophytes in a Reactor Cooling Reservoir,
W79-04880 5B

DYNATECH CORP., CAMBRIDGE, MA.
Heat Transfer in the Liquid-Liquid Spray Tower,
W79-04670 3A

ECOLOGICAL ANALYSTS, INC., MELVILLE, NY.
Use of Chlorine to Control OTEC Biofouling,
W79-04847 5B

EIDGENOESSISCHE ANSTALT FUER WASSERVERSORGUNG, ABWASSERREINIGUNG UND GEWAESSERSCHUTZ, ZURICH (SWITZERLAND).
The Interrelationships Among Chemical Parameters in Rivers--Analysing the Effect of Natural and Anthropogenic Sources,
W79-04569 5B

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND).
A Procedure for Interpolating the Depth Distribution of Soil Moisture Tension (In German),
W79-04723 8B

ELECTRICITE DE FRANCE, PARIS, DIRECTION DE L'EQUIPMENT.
The Influence of Temperature and Wet Weight on the Oxygen Demand of Rainbow Trout (Salmo Gairdneri R.) in Fresh Water,
W79-04832 5C

ENERGY RESOURCES CO., INC., CAMBRIDGE, MA.; AND SASAKI ASSOCIATES INC., WATERTOWN, MA.
Case Studies and Comparative Analyses of Issues Associated with Productive Land Use at Dredged Material Disposal Sites,
W79-04926 5E

ENGINEERING-SCIENCE, INC., ARCADIA, CA.
Quality Considerations for Water Supply Evaluations,
W79-04714 6B

ENVIRONMENT CONTROL, INC., ROCKVILLE, MD.
Critical Review of Estimating Benefits of Air and Water Pollution Control,
W79-04762 6B

ENVIRONMENTAL PROTECTION AGENCY, ATHENS, GA. SURVEILLANCE AND ANALYSIS DIV.
Ambient Concentrations of PCBs in the Southeast from Storet Data and Selected EPA Studies,
W79-04848 5A

ENVIRONMENTAL PROTECTION AGENCY, DALLAS, TX. REGION VI.
Benefits and Costs of Water Quality Improvements,
W79-04699 6B

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC.
Oil Shale and the Environment,
W79-04522 6B

ENVIRONMENTAL RESEARCH LAB., ATHENS, GA.
Mathematical Modeling of Pesticides in the Environment,
W79-04648 5B

Transformation and Transport Processes in Aquatic Systems,
W79-04656 5B

Predicting and Simulating Pesticide Transport from Agricultural Land: Mathematical Model Development and Testing,
W79-04920 5B

ENVIRONMENTAL RESEARCH LAB., DULUTH, MN.
Toxic Effects of Zinc on Fathead Minnows Pimephales Promelas in Soft Water,
W79-04837 5C

ENVIRONMENTAL RESEARCH LAB., GULF BREEZE, FL.
Impact of Pesticides on the Marine Environment,
W79-04550 5C

ENVIRONMENTAL RESEARCH LAB., NARRAGANSETT, RI.
Persistence Limits in Ecological Systems,
W79-04548 5C

ESTABLISSEMENTS KUHLMANN, PARIS (FRANCE). PRODUITS CHIMIQUES. (ASSIGNEE).
Process for the Sequestration of Oxygen Dissolved in Water and Compositions Useful for Such Purpose,
W79-04884 5F

FARBENFABRIKEN BAYER A.G., LEVERKUSEN (GERMANY, F.R.). (ASSIGNEE).
Degradation of Organic Compounds in Effluents by Wet Oxidation,
W79-04892 5D

FEDERAL ENERGY REGULATORY COMMISSION, WASHINGTON, DC. BUREAU OF POWER.
Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing--Lower White River Basin, Missouri-Arkansas.
W79-04872 4A

FISH AND WILDLIFE SERVICE, LAUREL, MD. PATUXENT WILDLIFE RESEARCH CENTER.
No. 2 Fuel Oil Decreases Embryonic Survival of Great Black-Backed Gulls,
W79-04628 5C

FISHERIES AND MARINE SERVICE, NANAIMO (BRITISH COLUMBIA). PACIFIC BIOLOGICAL STATION.
Transport of Nutrients and Carbon from the Nanaimo River to its Estuary,
W79-04726 2L

FISHERIES AND MARINE SERVICE, VANCOUVER (BRITISH COLUMBIA). DEPT. OF FISHERIES AND OCEAN.
Phytoplankton Ecology of Vancouver Harbor,
W79-04617 5B

FLORIDA STATE UNIV., TALLAHASSEE. DEPT. OF OCEANOGRAPHY.
Use of Biological Indicators for Monitoring Effect of Pollutants on the Marine Environment,
W79-04546 5C

Report of the Joint American-Soviet Expedition on the Scientific Research Vessel 'Moscow University' for the First Stage of Intercalibration of Methods for the Hydrobiological Analysis of Aquatic Ecosystems,
W79-04553 5C

FLORIDA UNIV., GAINESVILLE. DEPT. ENVIRONMENTAL ENGINEERING SCIENCES.
Sources, Levels, and Reactions of Boron in Florida Waters,
W79-04603 2K

FLORIDA UNIV., GAINESVILLE. DEPT. OF AGRICULTURAL ENGINEERING.
Drip Irrigation of Orange Trees in Humid Climate,
W79-04991 3F

FLORIDA UNIV., GAINESVILLE. DEPT. OF CHEMISTRY.
Water and Ion Flow Through Imperfect Osmotic Membranes,
W79-04937 3A

FLORIDA UNIV., GAINESVILLE. DEPT. OF CIVIL ENGINEERING.
Verification of an Estuarine Model for Apalachicola Bay, Florida,
W79-04582 2L

FLORIDA UNIV., GAINESVILLE. DEPT. OF FRUIT CROPS.
Measurement of Evaporation from Lakes and Ponds in Florida,
W79-04583 2D

FLORIDA UNIV., GAINESVILLE. WATER RESOURCES RESEARCH CENTER.
Mathematical Methods for Analysis of Fresh Water Lenses in the Coastal Zones of the Floridan Aquifer,
W79-04961 4B

FLUOR CORP., WHITTIER, CA.
Study of the Applicability of Combining Nuclear Reactors with Saline Water Distillation Processes,
W79-04938 3A

FMC CORP., SAN JOSE, CA. (ASSIGNEE).
Sewage Treatment System,
W79-04886 5D

FRANKLIN INST., PHILADELPHIA, PA.
Bibliography of the Literature on Dropwise Condensation, 1930-64,
W79-04669 3A

GENERAL ACCOUNTING OFFICE, WASHINGTON, DC.
Improvements Needed in the Corps of Engineers' Regulatory Program for Protecting the Nation's Waters.
W79-04871 6B

GENERAL ATOMIC CO., SAN DIEGO, CA.
Reverse Osmosis for Water Desalination,
W79-04516 3A

GEOLOGICAL SURVEY, ALBANY, NY. WATER RESOURCES DIV.
Hydrologic Appraisal of the Water Resources of the Homer-Preble Valley, New York,
W79-04796 6D

GEOLOGICAL SURVEY, BATON ROUGE, LA. WATER RESOURCES DIV.
Analyses of Water, Core Material, and Elutriate Samples Collected Near Yazoo City, Mississippi, (Yazoo Headwater Project),
W79-04793 1B

Geohydrology of the Northern Louisiana Salt-Dome Basin Pertinent to the Storage of Radioactive Wastes--A Progress Report,
W79-04810 5E

GEOLOGICAL SURVEY, BAY ST. LOUIS, MS.
Laboratory Studies of Gas Tracers for Reaeration,
W79-04712 5A

GEOLOGICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.
Maps Showing Formation Temperatures and Configurations of the Tops of the Minnelusa Formation and the Madison Limestone, Powder River Basin, Wyoming, Montana, and Adjacent Areas,
W79-04799 7C

A Computer Program for Simulating Salinity Loads in Streams,
W79-04800 5B

Chemical Analyses of Water from the Minnelusa Formation and Equivalents in the Powder River Basin and Adjacent Areas, Northeastern Wyoming,
W79-04807 5B

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.
Pennsylvania Annual Progress Report, 1978,
W79-04797 7C

GEOLOGICAL SURVEY, HONOLULU, HI. WATER RESOURCES DIV.
U.S. Geological Survey's Role in the Collection and Analysis of Peak-Flow Data on the Island of Oahu, Hawaii,
W79-04812 2E

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
Water Resources Data for Colorado, Water Year 1977--Volume 1. Missouri River Basin, Arkansas River Basin, Rio Grande Basin.
W79-04790 7C

Water Resources Data for Colorado, Water Year 1977--Volume 2. Colorado River Basin Above Dolores River.
W79-04791 7C

Water Resources Data for Colorado, Water Year 1977--Volume 3. Dolores River Basin, Green River Basin, San Juan River Basin.
W79-04792 7C

Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development,
W79-04808 6A

GEOLOGICAL SURVEY, LINCOLN, NE. WATER RESOURCES DIV.
Predictive Analyses of Ground-Water Discharges in the Willow Creek Watershed, Northeast Nebraska,
W79-04805 6A

GEOLOGICAL SURVEY, LITTLE ROCK, AR. WATER RESOURCES DIV.
Water-Quality Investigation of the Yellville Watershed, Arkansas,
W79-04802 7C

GEOLOGICAL SURVEY, MADISON, WI. WATER RESOURCES DIV.
Water-Level Declines in the Madison Area, Dane County, Wisconsin,
W79-04809 7C

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
Selected Water-Quality Data from the Merced River, California, November 1976 Through August 1977,
W79-04794 5B

GEOLOGICAL SURVEY, MILFORD, PA. WATER RESOURCES DIV.; AND GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
Institutional Concerns: The Delaware Experience,
W79-04804 4A

GEOLOGICAL SURVEY, PHOENIX, AZ. WATER RESOURCES DIV.
Satellite Snow-Cover Observations in Arizona,
W79-04803 7B

GEOLOGICAL SURVEY, PITTSBURGH, PA. WATER RESOURCES DIV.
Postimpoundment Survey of Water-Quality Characteristics of Raystown Lake, Huntington and Bedford Counties, Pennsylvania,
W79-04806 2H

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
Computer Model of Two-Dimensional Solute Transport and Dispersion in Ground Water,
W79-04813 6A

GEOLOGICAL SURVEY, RICHMOND, VA. WATER RESOURCES DIV.
Flood-Plain Delineation for Horsepen Run, Sugarland Run, Nichols Run, and Pond Branch Basins, Fairfax County, Virginia,
W79-04801 2E

GEOLOGICAL SURVEY, ROLLA, MO. WATER RESOURCES DIV; AND MISSOURI DEPT. OF NATURAL RESOURCES, ROLLA. DIV. OF GEOLOGY AND LAND SURVEY.
Water Resources and Geology of the Springfield Area, Missouri,
W79-04798 7C

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Summary of Hydrologic Data Collected During 1976 in Dade County, Florida,
W79-04795 7C

GEORGIA INST. OF TECH., ATLANTA. DEPT. CIVIL ENGINEERING.
Reduction of Aqueous HOCl with Activated Carbon,
W79-04615 5F

GEORGIA UNIV., ATHENS. DEPT. OF AGRICULTURAL ENGINEERING.
Peach Tree Response to Drip Application of Water and Nutrients,
W79-04981 3F

GEORGIA UNIV., ATHENS. DEPT. OF FOOD SCIENCE.
Behavior of Mercury in Bio-Systems II. Depuration of 203HG2+ in Various Trophic Levels,
W79-04619 5B

GEORGIA UNIV., ATHENS. INST. OF NATURAL RESOURCES.
A Viable Methodology to Implement the Principles and Standards,
W79-04692 6A

GOTEBORG UNIV. (SWEDEN). DEPT. OF ZOOLOGY.
Effects of Temperature and Salinity on the Life Cycle of Ophryotrocha Diadema (Polychaeta, Dorvilleidae),
W79-04823 5C

GULF GENERAL ATOMIC, INC., SAN DIEGO, CA.
Reverse Osmosis Field Testing on Acid Mine Waters at Norton, West Virginia,
W79-04947 3A

HARVARD UNIV., CAMBRIDGE, MA. DEPT. OF CITY AND REGIONAL PLANNING.
On the Choice of the 'Appropriate Model' for Water Resources Planning and Management,
W79-04612 6A

Analyzing the Impact of Land Use on Sewer Service Area Planning,
W79-04701 6A

HAWAII, UNIV., HONOLULU. DEPT. OF BOTANY.
Edible-Oil Pollution on Fanning Island,
W79-04841 5B

HAWAII UNIV., HONOLULU. DEPT. OF CIVIL ENGINEERING.
Estimation of Urban Irrigation Water Use and Requirement,
W79-04984 3D

HAWAII UNIV., HONOLULU. DEPT. OF GEOLOGY AND GEOPHYSICS.
Waste Injection into a Two-Phase Flow Field: Sand-Box and Hele-Shaw Models Study,
W79-04599 5E

HOKKAIDO UNIV., SAPPORO (JAPAN). DEPT. OF CIVIL ENGINEERING.
Disaggregation of Streamflow Volumes,
W79-04878 2E

HONG KONG UNIV. DEPT. OF GEOGRAPHY AND GEOLOGY.
Carbonate Chemistry of Groundwater from Tropical Tower Karst in South Thailand,
W79-04752 2F

HYDROCHEMICAL INST., NOVOCHERKASSK (USSR).
Hexachlorocyclohexane, Metaphos, and Chlorophos Decomposition in Soil and Their Migration with the Waters of Surface Runoff,
W79-04654 5B

HYDRODYNE DEVELOPMENT CO., FORESTVILLE, CA.
Managing the Low-Yield Water Well,
W79-04580 4B

HYDROSCIENCE, INC., WESTWOOD, NJ.
Optics of Turbid Estuarine Waters: Approximations and Applications,
W79-04734 1A

IBM SCIENTIFIC CENTER, VENICE (ITALY).
On the Use of a Main Trend for the Kriging Technique in Hydrology,
W79-04870 2F

IDAHO UNIV., MOSCOW.
Effects of Availability of Water on Irrigation Systems Operations,
W79-04683 3F

Optimal Irrigation Management Strategy Under Hydrologic and Irrigation Efficiency Uncertainty Regimes,
W79-04685 3F

ILLINOIS STATE DEPT. OF TRANSPORTATION, CHICAGO. DIV. OF WATER RESOURCES.
Illinois Coastal Zone Management Program, 2nd Year Work Product. Volume II. Coastal Geological Studies, Hydrogeologic, Geologic, and Engineering Aspects of Lake Michigan Surficial Deposits,
W79-04874 2F

ILLINOIS STATE WATER SURVEY, URBANA.
Solar Energy Information and Data for Illinois,
W79-04719 2B

Public Groundwater Supplies in Warren County,
W79-04720 7C

Winter Storms and the Record-Breaking Winter in Illinois,
W79-04839 2B

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF AGRICULTURAL ENGINEERING.
Failure Criteria for Corrugated-Plastic Drain Tubing,
W79-04979 8G

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF AGRONOMY.
Dry Matter Production and Translocation in Maize Subjected to Drought During Grain Fill,
W79-04606 2I

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.
Temporal Moments for Longitudinal Dispersion,
W79-04732 5B

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND).
Urban Runoff from a Road Surface--A Water Quality Study,
W79-04567 5B

INDUSTRIAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OH.
Pollution Control Guidance for Geothermal Energy Development,
W79-04530 5C

INSTITUTE OF BIOLOGY OF THE SOUTHERN SEAS, SEVASTOPOL (USSR).
Oil and Marine Organisms,
W79-04551 5C

INSTITUTE OF EXPERIMENTAL METEOROLOGY, OBNINSK (USSR).
Estimation of Organochlorine Pesticide Loss in Surface Runoff Waters,
W79-04655 5B

On the Estimation of the Anthropogenic Pollution Effect on the Functional State of the Soil Microflora,
W79-04657 5C

Certain Laws of Organochlorine Pesticide Redistribution in the Soil-Water, Soil-Plant System,
W79-04921 5B

INSTITUTE OF HYDROLOGY, OXON (ENGLAND).
A Note on the Dynamic Calibration of Tipping-Bucket Gauges,
W79-04903 2B

INSTITUTE OF PAPER CHEMISTRY, APPLETON, WI.
Removal of Color from Carbonate Pulping Effluent -- The Calcium-Magnesium Coagulation Process,
W79-04635 5D

Toxicity Removal by Primary Treatment (of Kraft Pulp Mill Effluent),
W79-04637 5D

Biosolids as Food,
W79-04638 5C

INSTYTUT INZYNIERII OCHRONY SRODOWISKA POLITECHNIKI SLASKIEJ, GLIWICE (POLAND).
Application of Reverse Osmosis and Ultrafiltration to Purification of Pulp and Paper Industry Effluents. VI. Purification of Pulp Bleaching Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemysłu celulozowo-papierniczego),
W79-04632 5D

INTERNATIONAL INST. FOR APPLIED SYSTEMS ANALYSIS, LAXENBURG (AUSTRIA).
IIASA Conference' 76.
W79-04686 6A

Tisza and Vistula River Basins: Case Studies,
W79-04687 6A

Applying Multiattribute Utility Theory to Evaluation of Tisza River Basin Development Plans,
W79-04688 6A

Application of On-line Prediction Techniques to Forecasting Short Term Agricultural Water Demand,
W79-04689 6D

INTERNATIONAL LAB. OF MARINE RADIOACTIVITY, MONTE CARLO (MONACO). OCEANOGRAPHIC MUSEUM.
Uptake from Water and Tissue Distribution of Neptunium-237 in Crabs, Shrimp and Mussels,
W79-04975 5A

INTERNATIONAL RICE RESEARCH INST., LOS BANOS, LAGUNA (PHILIPPINES). DEPT. OF IRRIGATION AND WATER MANAGEMENT.
Quantification of Rice Yield Benefits Attributable to Irrigation Water,
W79-04999 3F

IOWA STATE UNIV., AMES.
Channelization and Invertebrate in Some Iowa Streams,
W79-04789 2E

IRKUTSKII INST. OF ORGANIC CHEMISTRY (USSR).
Electrochemical Coagulation of Industrial Effluents (Elektrokhimicheskaya koagulyatsiya promyshlennykh stokov),
W79-04630 5D

IVL-CONSULTING LTD., GOTEBORG (SWEDEN).
Advanced Steps Towards the Pollution-Free Bleached Sulfite Mill,
W79-04639 3C

JBF SCIENTIFIC CORP. WILMINGTON, MA.
An Analysis of the Functional Capabilities and Performance of Silt Curtains.
W79-04924 5E

JOHNS HOPKINS UNIV., LAUREL, MD. APPLIED PHYSICS LAB.
Three-Dimensional Temperature Model for Shallow Lakes,
W79-04731 5B

JOHNS-MANVILLE RESEARCH AND ENGINEERING CENTER, MANVILLE, NJ.
A Pilot Plant Study to Provide Improved Quality Feed Water for the Webster, South Dakota Electrodialysis Plant,
W79-04510 5F

KANSAS STATE UNIV., MANHATTAN. DEPT. OF AGRICULTURAL ENGINEERING.
Sizing Tailwater Recovery Systems to Utilize Runoff from Precipitation on Irrigated Lands,
W79-04960 3F

KANSAS WATER RESOURCES RESEARCH INST., MANHATTAN.
Improvement of the Steady Floating Random Walk Monte Carlo Method Near Straight Line and Circular Boundaries with Application to Groundwater Flow,
W79-04557 2F

Application of the Frequency-Equivalent Non-Linear Hydrograph Method of Flood Frequency Analysis in Urban Basins,
W79-04788 2A

Preliminary Assessment of Policy and Management Options for Groundwater Mining in the Great Plains,
W79-04957 4B

KANSAS WATER RESOURCES RESEARCH, MANHATTAN.
Effects of Heavy Metals Especially Selenium, Vanadium and Zirconium on Movement, Growth and Survival of Certain Animal Aquatic Life,
W79-04592 5C

KAYE (JOSEPH) AND CO., INC., CAMBRIDGE, MA.
Study of Multi-Phase Ejectors for Freezing Process Desalination Systems,
W79-04935 3A

KEIFER AND ASSOCIATES, INC., CHICAGO, IL.
Regional Water Supply Planning Study for Northeastern Illinois,
W79-04717 6A

KENT STATE UNIV., OH. DEPT. OF BIOLOGICAL SCIENCES.
Evaluation of Aluminum Sulfate for Phosphorus Control in Eutrophic Lakes,
W79-04958 5C

KENT STATE UNIV., OH. DEPT. OF GEOLOGY.
Effects of Diversion and Alum Application on Two Eutrophic Lakes,
W79-04536 5C

KERN COUNTY WATER AGENCY, BAKERSFIELD, CA.
Agricultural Drainage Problems in Kern County, California,
W79-04909 5G

KINNERET LIMNOLOGY LAB., TIBERIAS (ISRAEL).
The Productivity of Mesocyclops Leuckarti (Claus) in Lake Kinneret (Israel),
W79-04773 5C

KOBE UNIV. (JAPAN). DEPT. OF BIOLOGY.
Notes on Freshwater Red Algae from West Malaysia,
W79-04768 5C

KOPPERS CO., INC., PITTSBURGH, PA.
Development of an Analytical Method for Measuring the Hydrocarbon Content in Water,
W79-04667 3A

The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-04671 3A

LIVERPOOL UNIV. (ENGLAND). DEPT. OF MARINE BIOLOGY.
The Effects of Some Pollutants on the Survival, Growth and Respiration of Laminaria Hyperborea,
W79-04834 5C

LOCKHEED CENTER FOR MARINE RESEARCH, CARLSBAD, CA.
Comparison of a High Volume Pump and Conventional Plankton Nets for Collecting Fish Larvae Entrained in Power Plant Cooling Systems,
W79-04703 5A

LONDON UNIV. (ENGLAND). DEPT. OF BOTANY; AND LONDON UNIV. (ENGLAND). DEPT. OF BIOCHEMISTRY.
Lead Accumulation in Plankton Blooms from Ullswater, The English Lake District,
W79-04819 5C

LOS ANGELES COUNTY SANITATION DISTRICTS, WHITTIER, CA. SAN JOSE CREEK WATER QUALITY LAB.
Ammonia Toxicity and pH Control in Fish Toxicity Bioassays of Treated Wastewaters,
W79-04817 5C

MACMILLAN BLOEDEL LTD., VANCOUVER (BRITISH COLUMBIA).
A Colorimetric Analysis for Abietic-Type Resin Acids in Pulping Effluents,
W79-04636 5A

MACQUARIE UNIV., NORTH RYDE (AUSTRALIA). SCHOOL OF BIOLOGICAL SCIENCES.
Photosynthesis, Transpiration, and Leaf Elongation in Corn Seedlings at Suboptimal Soil Temperatures,
W79-04608 2I

MAINE UNIV. AT ORONO.
Dissolved Oxygen Demand of Reduced Chemical Species in the Water Column of Sebasticook Lake, Maine,
W79-04684 2H

MAINE UNIV. AT ORONO. LAND AND WATER RESOURCES INST.
Radon in Potable Water Supplies in Maine,
W79-04593 5B

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM, PLYMOUTH (ENGLAND). PLYMOUTH LAB.
The Hydrolysis of Ammonium Ions in Sea Water-Experimental Confirmation of Predicted Constants at One Atmosphere Pressure,
W79-04844 5A

MARINE BIOLOGY STATION, ARRAIAL DO CABO (BRAZIL).
Seasonal Growth and Succession of Tropical and Introduced Phytoplankton Cultured in Deep Sea Water,
W79-04772 5C

MARYLAND UNIV., COLLEGE PARK. CENTER OF ENVIRONMENTAL AND ESTUARINE STUDIES.
Tuberculation of Pearl Dace, Semotilus Margarita (Pisces: Cyprinidae),
W79-04663 6G

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. ENERGY LAB.
The Incomplete Means Estimation Procedure Applied to Flood Frequency Analysis,
W79-04741 2E

Birth of a Parent: The Wakeby Distribution for Modeling Flood Flows,
W79-04742 2E

MASSACHUSETTS INST. OF TECHNOLOGY, CAMBRIDGE.
Washing of Brine from Ice Crystals,
W79-04674 3A

MELBOURNE UNIV., PARKVILLE (AUSTRALIA). SCHOOL OF BOTANY.
Accumulation of Heavy Metals by the Marine Diatom Ditylum Brightwellii (West) Grunow,
W79-04822 5C

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF CROP AND SOIL SCIENCES.
Nitrate and Phosphorus Runoff Losses from Small Watersheds in Great Lakes Basin,
W79-04535 5C

MIDWEST RESEARCH INST., KANSAS CITY, MO.
The Mechanism of Mass Transfer Through a Liquid Interface,
W79-04666 3A

MIDWEST RESEARCH INST., MINNETONKA, MN. NORTH STAR DIV.
Second Report on Fabrication and Evaluation of New Ultrathin Reverse Osmosis Membranes,
W79-04678 3A

MIE PREFECTURAL UNIV., TSU (JAPAN). FACULTY OF FISHERIES.
Studies on Toxic Effects of Pesticides on Fish - II Toxic Effects of the Herbicide, Benthiocarb, on Carp. (In Japanese),
W79-04826 5C

Studies on Toxic Effects of Pesticides on Fish-I. Toxic Effects of the Herbicide, Molinate, on Carp,
W79-04828 5C

MILAN UNIV. (ITALY). IST. DI ELETTROTECHNICA ED ELETTRONICA.
Supply-Demand Price Coordination in Water Resources Management,
W79-04718 6D

MILJOSTYRELSEN, CHARLOTTENLUND (DENMARK). MARINE POLLUTION LAB.
Effect of Copper on Volume Regulation in the Marine Flagellate Dunaliella Marina,
W79-04972 5C

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, BURNHAM-ON-CROUCH (ENGLAND). FISHERIES LAB.
Determination of Petroleum Hydrocarbons in Water, Fish and Sediments Following the Ekofisk Blow-Out,
W79-04976 5A

MINISTRY OF THE INTERIOR, JERUSALEM (ISRAEL). WATER QUALITY.
Solution of Granular Bed Filtration Equations,
W79-04716 5F

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF AGRICULTURAL ENGINEERING.
Economic Analyses of Multiple Pivot Irrigaton on a Droughty Soil,
W79-04995 3F

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF CIVIL AND MINERAL ENGINEERING.
A New Function for Use in the Hodograph Method,
W79-04748 2F

MINNESOTA UNIV., ST. PAUL. DEPT. OF AGRICULTURAL ENGINEERING.
Rapid Determination of Soil Water Characteristic by Thermocouple Psychrometry,
W79-04987 2G

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE.
Chemical Precipitation-Coagulation for Organic Color Removal from Groundwaters,
W79-04614 5F

MISSOURI UNIV.-COLUMBIA. DEPT. OF CHEMISTRY.
Coal Humic Substances for the Treatment of Wastewater from Stack Gas Scrubbers, Coal Conversion Plants, and Other Coal Utilization Facilities,
W79-04554 5D

MISSOURI UNIV.-ROLLA. DEPT. OF CIVIL ENGINEERING.
Removal of Ammonia Nitrogen from Wastewater by Partial Chlorination Followed by Activated Carbon Treatment,
W79-04556 5D

MISSOURI WATER RESOURCES CENTER, COLUMBIA.
Expression and Repression of Special Interests in Planning and Management of the Meramec Park Reservoir,
W79-04647 6B

MONASH UNIV., CLAYTON (AUSTRALIA). DEPT. OF BOTANY.
Morphological Variation and Life History in Cylindrical Forms of Scytosiphon Lomentaria (Scytosiphonaceae: Phaeophyta) from Southern Australia,
W79-04778 5C

MONSANTO RESEARCH CORP., DAYTON, OH.
Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State of the Art,
W79-04529 5D

MONSANTO RESEARCH CORP., EVERETT, MA.
Thermodynamic Properties of Saline Water,
W79-04941 3A

MOSCOW STATE UNIV. (USSR). DEPT. OF BIOLOGY.
The Development of Standard Methods of Measuring Microbiological Production,
W79-04545 5C

The Development of Standard Laboratory and Field Ecosystem Research to Determine the Effects of Pollutants on the Marine Environment,
W79-04549 5C

MOSCOW STATE UNIV. (USSR). DEPT. OF HYDROBIOLOGY.
Relative Abundance of Sympatric Species and Model of Exponentially Broken Rod (EBR),
W79-04541 5C

MOSKOVSKAYA SELSKOKHOZYAISTVENNAYA AKADEMIYA (USSR).
Basic Mathematical Models of Toxicant Transport Through the Soil Profile,
W79-04649 5B

MOSS LANDING MARINE LAB., CA.
Impact of Metals on the Marine Environment,
W79-04552 5C

MURMANSKII MORSKOI BIOLOGICHESKII INST. (USSR).
Microorganisms as Biological Indicators of Commercial-Domestic and Petroleum Pollution,
W79-04547 5C

NAGOYA UNIV. (JAPAN). RESEARCH INST. FOR BIOCHEMICAL REGULATION.
Pathway and Products of CO2-Fixation by Green Prokaryotic Algae in the Cloacal Cavity of Diplosoma Virens,
W79-04787 5C

NANCY-1 UNIV. (FRANCE). LAB. DE TOXICOLOGIE.
Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary,
W79-04730 2L

NAT. ULRICH BAENSCH G.M.B.H., MELLE (GERMANY, F.R.). TETRA WERKE. (ASSIGNEE).
Process and Apparatus for Removing Impurities Dissolved in Water,
W79-04894 5D

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.
Rapid, Quantitative Determination of Bacteria in Water,
W79-04877 5A

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER; AND GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Time-Dependence of Sea-Ice Concentration and Multiyear Ice Fraction in the Arctic Basin,
W79-04811 7B

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, PASADENA, CA. JET PROPULSION LAB.
Extracting Lignins from Mill Wastes,
W79-04640 5D

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., KALAMAZOO, MI.
Filter Belts vs. Pressure in Dewatering of Sludges,
W79-04641 5D

NATIONAL FERTILIZER DEVELOPMENT CENTER, MUSCLE SHOALS, AL.
Nutrient Effectiveness in Relation to Rates Applied for Pot Experiments: I. Nitrogen and Potassium,
W79-04992 2G

Nutrient Effectiveness in Relation to Rates Applied for Pot Experiments: II. Phosphorus Sources,
W79-04993 2G

NATIONAL INST. FOR WATER RESEARCH, CONGELLA (SOUTH AFRICA). REGIONAL LAB.
Nutrient Budget for a Residential Stormwater Catchment in Durban, South Africa,
W79-04565 5B

NATIONAL MARINE FISHERIES SERVICE, ANN ARBOR, MI. NATIONAL POWER PLANT TEAM.
Federal Water Pollution Control Act: The Sections 316 (A) and 316 (B) Process,
W79-04507 6E

NATIONAL MARINE FISHERIES SERVICE, BEAUFORT, NC.
Impact of Radioactivity on the Marine Environment,
W79-04542 5C

NATIONAL MARINE FISHERIES SERVICE, MILFORD, CT. EXPERIMENTAL BIOLOGIAL INVESTIGATIONS.
Some Effects of Gas-Supersaturated Seawater on Spisula Solidissima and Argopecten Irradians,
W79-04829 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MI. GREAT LAKES ENVIRONMENTAL RESEARCH LAB.
Entrainment of Larval Fish by the Douglas Point Generating Station, Lake Huron, in Relation to Seasonal Succession and Distribution,
W79-04816 5C

NATIONAL SPACE TECHNOLOGY LABS., NSTL STATION, MS.
Upgrading Faculative Wastewater Lagoons with Vascular Aquatic Plants,
W79-04830 5D

NATIONAL WEATHER SERVICE, SILVER SPRING, MD. OFFICE OF HYDROLOGY.
Interstorm Relations in Pacific Northwest,
W79-04733 2B

NEBRASKA UNIV., LINCOLN. DEPT. OF AGRICULTURAL ENGINEERING.
A Simplified Model of Corn Growth Under Moisture Stress,
W79-04607 2D

Management for Minimizing Nitrogen Leaching Losses on Irrigated Sandy Soils,
W79-04980 3F

NEW BRUNSWICK UNIV., ST. JOHN. DIV. OF SCIENCES.
The Growth and Death of the Macrocystis Sporophyte (Phaeophyceae, Laminariales),
W79-04786 5C

NEW ENGLAND RIVER BASINS COMMISSION, BOSTON, MA.
The River's Reach: A Unified Program for Flood Plain Management in the Connecticut River Basin.
W79-04857 4A

NEW HAMPSHIRE UNIV., DURHAM. INST. OF NATURAL AND ENVIRONMENTAL RESOURCES.
Drainage Density and Streamflow: A Closer Look.
W79-04736 2E

NEW MEXICO HIGHLANDS UNIV., LAS VEGAS.
Behavior of Water in Various States,
W79-04951 1A

NEW MEXICO INST. OF MINING AND TECHNOLOGY, SOCORRO.
Stochastic Analysis of Spatial Variability in Subsurface Flows 2. Evaluation and Application,
W79-04753 2F

NEW MEXICO STATE UNIV., LAS CRUCES.
Potato and Lettuce Response to Irrigation Methods and Practices,
W79-04997 3F

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF BIOLOGY.
Inactivation of Polioviruses and Coxsackieviruses in Surface Water.
W79-04591 5B

NEW MEXICO WATE RESOURCES RESEARCH INST., LAS CRUCES.
Water in Land Use Planning.
W79-04681 6A

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA).
Economic Performance of Reservoirs a Sensitivity Analysis,
W79-04711 6B

NEW YORK UNIV., NY. ENGINEERING RESEARCH DIV.
Research on Methods for Solar Distillation,
W79-04513 3A

NEWCASTLE-UPON-TYNE UNIV. (ENGLAND). DEPT. OF ZOOLOGY.
Cadmium Turnover in the Shore Crab Carcinus Maenas,
W79-04973 5B

NORSK INST. FOR VANNFORSKNING, BLINDERN (NORWAY).
A New Aquarium for the Study of Temperature Behaviour of Fish,
W79-04846 5A

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF BIOLOGICAL AND AGRICULTURAL ENGINEERING.
Analysis of Combination Surface-Subsurface Drainage Systems for Humid Region Soils,
W79-04989 4B

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT OF POULTRY SCIENCE.
Ultrafiltration: A Potential Method to Treat Poultry Processing Wastewater with Protein Recovered as the By-Product,
W79-04501 5D

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF REGIONAL PLANNING.
Water Quality Planning in North Carolina,
W79-04922 6E

NORTH WEST WATER AUTHORITY (ENGLAND).
Pollution of a Water Supply Catchment by Breeding Gulls and the Potential Environmental Health Implications,
W79-04843 5B

NORTHWESTERN UNIV., EVANSTON, IL. DEPT. OF GEOLOGICAL SCIENCES.
Biological Control of Dissolved Aluminum in Seawater: Experimental Evidence,
W79-04824 5D

NOTRE DAME UNIV., IN. DEPT. OF CIVIL ENGINEERING.
Phosphate Removal Using Waste Calcium Sulfate,
W79-04977 5D

OAK RIDGE NATIONAL LAB., TN.
Temperature Influences on Growth of Aquatic Organisms,
W79-04851 5C

The Potential Impacts on Aquatic Ecosystems from the Release of Trace Elements in Geothermal Fluids,
W79-04881 5B

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Effects of Geothermal Energy Development of Fish and Wildlife,
W79-04508 5C

OCEAN WATER LTD., NASSAU (BAHAMAS). (ASSIGNEE).
Water Purification by Reverse Osmosis,
W79-04887 3A

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT (DI), WASHINGTON, DC. BRANCH OF ENVIRONMENTAL ANALYSIS.
Multisource/Multiquality Agricultural Water Use Decisionmaking,
W79-04693 3C

OFFICE OF WATER RESEARCH AND TECHNOLOGY, WASHINGTON, DC. BIOSCIENCES DIV.
Permeability Requirements of Membranes for Use in Desalination by Reverse Osmosis,
W79-04679 3A

Bibliography of Membrane Technology Pertaining to Saline Water Desalination: Part II.
W79-04945 3A

OFFICE OF WATER RESEARCH AND TECHNOLOGY, WASHINGTON, DC. POLYMER AND BIOPHYSICS DIV.
Recommended Procedures for the Testing and Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
W79-04944 3A

OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, COLUMBUS. DEPT. OF AGRICULTURAL ENGINEERING.
Prediction of Deflection for Corrugated Plastic Tubing,
W79-04983 8G

Subsurface Drain Spacing from Water Table and Outflow Measurements,
W79-04986 4B

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRICULTURAL ECONOMICS.
Water Utilization and Reallocation in Chile: A Study of the Pirque Valley,
W79-04695 6A

OKLAHOMA UNIV., NORMAN.
Evaluation of an Electrochemical Desalination Process for Brackish Wate,
W79-04518 3A

OKLAHOMA UNIV., NORMAN. BUREAU OF WATER AND ENVIRONMENTAL RESOURCES RESEARCH.
An Analytical Model for Establishing Water Resources Development Priorities,
W79-04586 6B

OREGON DEPT. OF ENVIRONMENTAL REGULATION, SALEM. WATER QUALITY DIV.
A Geographically Variable Water Quality Index Used in Oregon,
W79-04697 5A

OREGON STATE UNIV., CORVALLIS. DEPT. OF FOREST ENGINEERING.
Long-Term Patterns of Sediment Production Following Road Construction and Logging in the Oregon Coast Range,
W79-04750 2J

OREGON STATE UNIV., CORVALLIS. WATER RESOURCES RESEARCH INST.
Economic and Energy Analyses of Regional Water Pollution Control,
W79-04523 6B

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, PARIS (FRANCE).
Water Management Policies and Instrument.
W79-04856 5G

PADUA UNIV. (ITALY). IST. DI BOTANICA E FISIOLOGIA VEGETALE.
Occurrence of Endophytic Bacteria in Siphonous Algae,
W79-04783 5C

PARSON (RALPH M.) CO., PASADENA, CA.
Engineering and Economic Analysis of Waste to Energy Systems,
W79-04526 6B

PEDCO ENVIRONMENTAL, INC., CINCINNATI, OH.
Environmental Assessment of Coal Transportation,
W79-04531 5C

PEIGNAGE AMEDEE, ROUBAIX (FRANCE). (ASSIGNEE).
Process for the Purification of Greasy and Soiled Water Using a Heavy Solvent, and Apparatus for its Implementation,
W79-04890 5D

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRICULTURAL ENGINEERING.
Contour Furrow Irrigation with Liquid Manure Using 'Microtubing' for Flow Control,
W79-04982 3F

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.
Water-Conservation Methods to Meet Pennsylvania's Water Needs,
W79-04598 3D

POLYTECHNIC INST. OF NEW YORK, BROOKLYN. DEPT. OF CHEMISTRY.
Investigation of the Removal of Trace Toxic Heavy Metal Ions from Waste Water by Foam Fractionation,
W79-04754 5D

PROCESS RESEARCH, INC., CAMBRIDGE, MA.
Donnan Softening as a Pretreatment to Desalination Processes,
W79-04949 3A

PULP AND PAPER RESEARCH INST. OF CANADA, POINTE CLAIRE, (QUEBEC).
The Impact of Turpentine Recovery on the Toxicity and BOD of Kraft Mill Effluents,
W79-04534 5C

PUNJAB AGRICULTURAL UNIV., LUDHIANA (INDIA). DEPT. OF CIVIL ENGINEERING.
Galerkin Finite Element Procedure for Analyzing Flow Through Random Media,
W79-04859 2F

PURDUE UNIV., LAFAYETTE, IN. SCHOOL OF CIVIL ENGINEERING.
Reservoir System Operating Policy--Case Study,
W79-04616 6A

Planning Storm-Drainage Systems for Urban Growth,
W79-04618 6F

PURDUE UNIV., LAFEYETTE, IN. DEPT. AGRICULTURAL ENGINEERING.
Application of Land Treatment for Water Quality Improvement,
W79-04905 5G

PURDUE UNIV., LAGAYETTE, IN. DEPT. OF AGRICULTURAL ENGINEERING.
Deposition of Nonuniform Sediment on Concave Slopes,
W79-04917 2J

QUEEN MARY COLL., LONDON(ENGLAND). DEPT. OF ZOOLOGY AND COMPARATIVE PHYSIOLOGY.
Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. I. Accumulation from Seawater and a Food Source,
W79-04968 5A

Studies on the Uptake of Cadmium by the Crab Carcinus Maenas in the Laboratory. II. Preliminary Investigation of Cadmium-Binding Proteins,
W79-04969 5A

RESEARCH CORP., NEW YORK. (ASSIGNEE).
Apparatus and Method for Treating Waste-Containing Liquors,
W79-04893 5D

RHODE ISLAND UNIV., KINGSTON. COLL. OF PHARMACY.
Paralytic Shellfish Toxins in the Sea Scallop, Placopecten Magellanicus, in the Bay of Fundy,
W79-04825 5A

RHODE ISLAND UNIV., KINGSTON. GRADUATE SCHOOL OF OCEANOGRAPHY.
A Non-Standard Approach to Heterotrophy: ATP Estimation of Natural Populations of Selectively-Filtered Bacterioplankton and their Growth Rates on In-situ Water in Diffusion-Culture,
W79-04544 5C

RICE (CYRUS WM.) AND CO., PITTSBURGH, PA.
Corrosion Test Program,
W79-04677 3A

RICE UNIV., HOUSTON, TX. DEPT. OF BIOLOGY; AND RICE UNIV., HOUSTON, TX. DEPT. OF ENVIRONMENTAL SCIENCE AND ENGINEERING.
Acute Toxicity of 12 Industrial Chemicals to Freshwater and Saltwater Organisms,
W79-04845 5A

RIJKSINSTITUUT VOOR DRINKWATER-VOORZIENING, LEIDSCHENDAM (NETHERLANDS).
Continuous Standard Water Delivery System for Bioassays with Aquatic Organisms,
W79-04770 5C

ROBERT S. KERR ENVIRONMENTAL RESEARCH LAB., ADA, OK. WASTEWATER MANAGEMENT BRANCH.
Municipal Wastewater Aquaculture,
W79-04528 5D

ROCKWELL INTERNATIONAL, CANOGA PARK, CA. ROCKETDYNE DIV.
Mechanism of Electrode Demineralization,
W79-04672 3A

Nucleation and Growth of Ice Crystals,
W79-04673 3A

ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE, MIAMI, FL.
Design of Simulation Models to Determine Biological Impact of Pollutants on the Marine Environment,
W79-04538 5C

SABINE RIVER AUTHORITY OF TEXAS, ORANGE; AND HENNINGSON, DURHAM AND RICHARDSON, INC., HENDERSON, TX.
A Feasibility Study for Developing a Reservoir on Big Cow Creek, Newton County, Texas.
W79-04867 6B

SCIENCE AND EDUCATION ADMINISTRATION, FORT COLLINS, CO.
Groundwater and Salinity in the Grand Valley of Colorado,
W79-04985 5G

SCIENCE AND EDUCATION ADMINISTRATION, KIMBERLY, ID. SNAKE RIVER CONSERVATION RESEARCH CENTER.
Is the Soil Frozen or Not. An Algorithm Using Weather Records,
W79-04740 2G

SCIENCE AND EDUCATION ADMINISTRATION, PHOENIX, AZ., WATER CONSERVATION LAB.
Delayed Aquifer Yield as a Phenomenon of Delayed Air Entry,
W79-04744 2G

Assessing Trickle Emitter Application Uniformity,
W79-04990 3F

SCIENCE AND EDUCATION ADMINISTRATION, PROSSER, WA. AGRICULTURAL RESEARCH.
Corn Residue Management to Reduce Erosion in Irrigation Furrows,
W79-04724 4D

SCIENCE AND EDUCATION ADMINISTRATION, RIVERSIDE, CA. SALINITY LAB.
Environmental and Institutional Aspects of Irrigation Agriculture,
W79-04978 3F

SCIENCE APPLICATIONS, INC., BOULDER, CO.
Aspects of Water Column Primary Productivity in the Chukchi Sea During Summer,
W79-04765 5C

SCS ENGINEERS, RESTON, VA.
A Methodology for Determining Land Value and Associated Benefits Created from Dredged Material Containment,
W79-04933 5E

SEIKAI REGIONAL FISHERIES RESEARCH LAB., NAGASAKE (JAPAN).
The Effects of Heated Effluents on the Production of Marine Plankton (Takahama Nuclear Power Station-I) (In Japanese),
W79-04842 5B

SIBIRSKII NAUCHNO-ISSLEDOVATELSKII INST. TSELLYULOZY I KARTONA (USSR).
Utilization of Evaporator Condensates as a Replacement for Fresh Water (Ispol'zovanie kondensator vyparnogo tsekha vzamen svezhei vody),
W79-04646 5D

SKIDAWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.
Shelf Flushing Rates Based on the Distribution of Salinity and Freshwater in the Georgia Bight.
W79-04727 2L

Factors Controlling the Estuarine Chemistry of Arsenic,
W79-04728 2L

Feeding of Marine Planktonic Copepods in Mixed Phytoplankton,
W79-04781 5C

SMITHSONIAN INSTITUTION, EDGEWATER, MD. CHESAPEAKE BAY CENTER FOR ENVIRONMENTAL STUDIES.
The Relationship Between Aboveground and Belowground Biomass of Freshwater Tidal Wetland Macrophytes,
W79-04627 2I

SOIL CONSERVATION SERVICE, DES MOINES, IA.
Design and Operation of Gradient Terrace Systems,
W79-04918 2J

SOIL CONSERVATION SERVICE, GRAND ISLAND, NE.
Flat Channel Terraces for Pollution Abatement and Sediment Control,
W79-04914 4A

SOIL CONSERVATION SERVICE, MADISON, WI.
Flood Hazard Study: Bark River, Village of Dousman and Vicinity, Waukesha County, Wisconsin.
W79-04863 2E

SOIL CONSERVATION SERVICE, PORTLAND, OR.
Flood Hazard Analyses: McKenzie River, Hedricks Bridge to Leaburg Dam, Lane County, Oregon.
W79-04866 2E

SOIL CONSERVATION SERVICE, STILLWATER, OK.
Flood Hazard Analyses: Washita River, Rainy Mountain Creek, Mountain View and Vicinity, Kiowa County, OK.
W79-04860 2E

SOIL CONSERVATION SERVICE, TEMPLE, TX.
Field Evaluations of Groundwater Control by Trench and Trenchless Methods of Installed Drains--Lower Rio Grande Valley of Texas,
W79-04906 4B

SOUTH FLORIDA WATER MANAGEMENT DISTRICT, WEST PALM BEACH, FL.
Modified Water Quantity Receiving Model for Florida Conservation Areas,
W79-04691 6A

SOUTHERN RESEARCH INST., BIRMINGHAM, AL.
Development of Improved Ion-Selective Membranes for Desalting Water, Part I and Part II,
W79-04517 3A

Transport of Electrolytes Through Membrane Systems, Second Annual Report,
W79-04952 3A

SPEICHER CORP., CELINA, OH.
Drainage Installation Equipments 'Economics of the Art'.
W79-04910 5G

STANFORD UNIV., CA. DEPT. OF CIVIL ENGINEERING.
Environmental Considerations in Three Infrastructure Planning Agencies: An Overview of Research Findings.
W79-04680 6E

STATE UNIV. OF NEW YORK AT ALBANY.
The Osmionic Process.
W79-04948 3A

STATE UNIV. OF NEW YORK AT STONY BROOK. MARINE SCIENCES RESEARCH CENTER.
Stony Brook Harbor: An Interdisciplinary Analysis,
W79-04862 6B

STATE UNIV. OF NEW YORK, STONY BROOK. MARINE SCIENCES RESEARCH CENTER.
American Methods for Measuring Phytoplankton Production in the Open Ocean,
W79-04540 5C

STEARNS-ROGER CORPORATION, DENVER, CO. SPECIAL PROJECTS DIVISION.
Fourth Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-04953 3A

STEARNS-ROGER INC., DENVER, CO.
Fifth Annual Report, Saline Water Conversion Plant No. 1, Freeport, Texas.
W79-04519 3A

TECHNICAL UNIV. OF WARSAW (POLAND). INST. ZAOPATRZENIA W WODE I BUDOWNICTWA WODNEGO.
Pilot-Plant Study of Two-Stage Chemical-Biological Purification of Pulping Effluents at the Ostroleka Pulp and Paper Mill (Badania poltechniczne nad oczyszczaniem sciekow celulozowych z Ostroleckich Zakladow Celulozowo-Papierniczych w Ukladzie Dwustopniowym Chemiczno-Biologicznym),
W79-04631 5D

TECHNISCHE UNIV., HANOVER (GERMANY, F.R.). INST. FUER WASSERWIRTSCHAFT, HYDROLOGIE UND LANDWIRTSCHAFTLICHEN WASSERBAU.
Determining Nutrient Loading from Rainfall and Runoff in Small Rivers,
W79-04566 5B

TEL-AVIV UNIV. (ISRAEL). DEPT. OF BOTANY.
The Effects of Ammonium in Water on Potamogeton Lucens,
W79-04815 5C

TENNESSEE UNIV., KNOXVILLE.
Characterization of the Growth of Myriophyllum spicatum and Its Influence in the Aquatic Ecosystems of the Tennessee Valley,
W79-04625 4A

TENNESSEE UNIV., KNOXVILLE. DEPT. OF ENGINEERING SCIENCE AND MECHANICS.
Added Chlorine in Aquatic Environments,
W79-04899 5C

TENNESSEE UNIV., MEMPHIS. DEPT. OF BIOCHEMISTRY.
Heterotrophic Utilization of Organic Carbon in Aquatic Environments,
W79-04771 5C

TENNESSEE VALLEY AUTHORITY, DECATUR, AL. DIV. OF FORESTRY, FISHERIES AND WILDLIFE DEVELOPMENT.
Browns Ferry Biothermal Research Series. I. Colonization by Periphyton, Zooplankton, and Macroinvertebrates,
W79-04533 5C

TENNESSEE VALLEY AUTHORITY, KNOXVILLE.
Bulk Precipitation and Streamflow Quality Relationships in an Urban Area,
W79-04738 2E

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF OCEANOGRAPHY.
Volatile Liquid Hydrocarbons in the Surface Coastal Waters of the Gulf of Mexico,
W79-04560 5C

TEXAS A AND M UNIV., LUBBOCK. AGRICULTURAL RESEARCH AND EXTENSION CENTER.
Use of Methanol-Water Solutions for Freeze Protection of Tensiometers,
W79-04605 3F

TEXAS A AND M UNIV., OVERTON. AGRICULTURAL RESEARCH AND EXTENSION CENTER.
Calcium-Supplying Characteristics of Two Gypsum Materials on Southeastern Coastal Plain Soils,
W79-04662 2G

TEXAS AGRICULTURAL EXPERIMENT STATION, COLLEGE STATION.
Habitat Development Field Investigations, Bolivar Peninsula Marsh and Upland Habitat Development Site, Galveston Bay, Texas; Appendix D: Propagation of Vascular Plants and Post-Propagation Monitoring of Botanical, Soil, Aquatic Biota, and Wildlife Resources,
W79-04927 5E

TEXAS DEPT. OF WATER RESOURCES, AUSTIN.
Occurrence, Quantity, and Quality of Ground Water in Taylor County, Texas.
W79-04575 2F

Analytical Study of the Ogallala Aquifer in Dawson and Borden Counties, Texas, Projections of Saturated Thickness, Volume of Water in Storage, Pumpage Rates, Pumping Lifts, and Well Yields,
W79-04576 7C

TEXAS TECH UNIV., LOBBOCK. DEPT. OF GEOGRAPHY.
Problems of Public Access to Water in Texas Lakes and Streams: An Analysis,
W79-04555 6E

TEXAS TECH UNIV., LUBBOCK. DEPT. OF GEOGRAPHY.
An Analysis of Playa Lake Water Utilization on the Texas High Plains,
W79-04611 6E

TEXAS UNIV. AT AUSTIN. DEPT. OF CIVIL ENGINEERING.
Sewer Network Scheme for Digital Computations,
W79-04590 5D

THAMES WATER AUTHORITY, READING (ENGLAND).
A Mathematical Deterministic River-Quality Model. Part 2: Use in Evaluating the Water-Quality Management of the Blackwater Catchment,
W79-04722 5B

THAYER SCHOOL OF ENGINEERING, HANOVER, NH.
Anaerobic Digestion and Membrane Separation of Domestic Wastewater.
W79-04597 5D

THE FLUOR CORP. LTD., LOS ANGELES, CA.
Conceptual Design Study of a One Million Gallon Per Day MSM Desalination Plant Replacement for Demonstration Plant No. 2 at Point Loma, San Diego, California.
W79-04511 3A

TOHOKU UNIV., SENDAI (JAPAN). DEPT. OF FISHERIES.
Studies on the Post-Mortem Identification of the Pollutant in Fish Killed By Water Pollution - XIII Cadmium (In Japanese),
W79-04694 5A

TOHOKU UNIV., SENDAI (JAPAN). LAB. OF FOOD HYGIENE.
Occurrence of a New Type of Shellfish Poisoning in the Tohoku District,
W79-04970 5A

TOKYO UNIV. OF FISHERIES (JAPAN). LAB. OF FISH NUTRITION.
Requirement of Rainbow Trout for Dietary Magnesium, (In Japanese),
W79-04601 5C

TORO CO., RIVERSIDE, CA.
Computer Programming Solid Set Systems,
W79-04913 3F

TULANE UNIV., NEW ORLEANS, LA. DEPT. OF BIOLOGY.
Increased Spontaneous Locomotor Activity in the Fiddler Crab, Uca Pugilator, After Exposure to a Sublethal Concentration of DDT,
W79-04629 5C

UNIVERSIDAD CATOLICA DE CHILE, SANTIAGO. LAB. DE ZOOLOGIA.
New Records of Marine Algae from Chile and their Effect on Phytogeography,
W79-04785 5C

UNIVERSITY OF EAST ANGLIA, NORWICH (ENGLAND). SCHOOL OF ENVIRONMENTAL SCIENCES.
The Ecological History of a Mediaeval Man-Made Lake, Hickling Broad, Norfolk, United Kingdom,
W79-04777 5C

UNIVERSITY OF NEW ENGLAND, ARMIDALE (AUSTRALIA). DEPT. OF AGRICULTURAL ECONOMICS.
'Scope for Valuation of Environmental Goods': Comment,
W79-04757 6C

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES. (ASSIGNEE).
Purifying Oil Shale Retort Water,
W79-04883 5D

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES. ENVIRONMENTAL ENGINEERING PROGRAM.
Hazardous Wastes Input Into Class I Landfills,
W79-04715 5E

UNIVERSITY OF WEST FLORIDA, PENSACOLA. FACULTY OF BIOLOGY.
An Automated Device (AGARS) for Studying Avoidance of Pollutant Gradients by Aquatic Organisms,
W79-04696 5A

UPPSALA UNIV. (SWEDEN). DEPT. OF ZOOLOGY.
Trace Metals in the Common Mussel, Mytilus Edulis (L.), and in the Alga Fucus Vesiculosus (L.) from the Region of the Sound (Oresund),
W79-04840 5B

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, DENVER, CO.
Methodology for Evaluation of Feasibility: Multijurisdictional Urban Drainage and Flood Control Projects.
W79-04502 6F

URS CO., SEATTLE, WA.
Distribution of Stable Organic Molecules in the Marine Environment: Physical Chemical Aspects. Chlorinated Hydrocarbons,
W79-04559 5C

UTAH STATE UNIV., LOGAN. COLL. OF NATURAL RESOURCES.
Hydrologic Impact of Grazing Systems on Infiltration and Runoff: Development of a Model,
W79-04585 2A

UTAH STATE UNIV., LOGAN. DEPT. OF AGRICULTURE AND IRRIGATION ENGINEERING.
Drainage Requirements for Lowland Rice,
W79-04908 5G

UTAH STATE UNIV., LOGAN. DEPT. OF SOIL SCIENCE.
An Erosion Model for Arid Wildland Watersheds,
W79-04994 2J

VANDKVALITETSINSTITUTET, HOERSHOLM (DENMARK).
The Uptake and Release of Petroleum Hydrocarbons by the Marine Mussel Mytilus Edulis,
W79-04588 5A

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.
Factors Affecting Accuracy of Ichthyoplankton Samples Used in Power Plant Entrainment Studies,
W79-04504 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF BIOLOGY.
A Computer Monitored Aquatic Bioassay System,
W79-04652 5A

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF BIOLOGY; AND VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. CENTER FOR ENVIRONMENTAL STUDIES.
Response of Eurythermal and Stenothermal Fish Species to Chlorinated Discharges,
W79-04651 5B

A Simple Method for Screening Petroleum Effluents by In Vitro Enzyme Inhibition,
W79-04902 5C

VOITH (J. M.) G.M.B.H., HEIDENHEIM (GERMANY, F.R.).
Criteria for Selecting Installations for Fiber Recovery (Auswahlkriterien fuer Anlagen zur Faserrueckgewinnung),
W79-04633 5D

VSESOYUZNYI NAUCHNO-ISSLEDOVATELSKII INST. KUKURUZY, DNEPROPETROVSK (USSR).
Physiological Reaction of Different Corn Hybrids to Drought (In Russian),
W79-04708 3F

VSESOYUZNYI-NAUCHNYI PLANOVII OTDEL BUMAZHNOI PROMYSHLENNOST, MOSCOW (USSR).
Reagent-Free Method of Effluent Neutralization (Bezreagentnyi sposob neitralizatsii stochnykh vod),
W79-04642 5D

Mechanism of Aluminum Sulfate Recovery from Lignin Sludge (Mekhanism izvlecheniya sulfat alyuminiya iz shlam-lignina),
W79-04643 5D

Dewatering of High-Ash Sediments of Effluents (Obezvozhivamie vysokozolinykh osadkov stochnykh vod),
W79-04644 5D

Dynamics of Effluent Clarification (Dinamika osvetleniya stochnykhvod),
W79-04645 5D

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF AGRICULTURAL ENGINEERING.
Interceptor Drains on Sloping Land,
W79-04916 4A

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Predictive Model for Design of Fixed-Bed Adsorbers: Parameter Estimation and Model Development,
W79-04704 5D

WASHINGTON UNIV., SEATTLE. LAB. OF RADIATION ECOLOGY.
Aquatic Disposal Field Investigations, Duwamish Waterway Disposal Site, Puget Sound, Washington; Appendix D: Chemical and Physical Analyses of Water and Sediment in Relation to Disposal of Dredged Material in Elliott Bay; Vol. II: Sept.-Dec. 1976,
W79-04929 5B

WATER POLLUTION RESEARCH LAB., STEVENAGE (ENGLAND).
Enhancement of Water-Quality Monitoring Systems by Incorporating Water-Quality Modelling and Time-Series Analysis,
W79-04571 5B

Biological Surveillance of Rivers: A Biological Monitoring Handbook,
W79-04634 7B

A Mathematical Deterministic River-Quality Model. Part I: Formulation and Description,
W79-04721 5B

WATERLOO UNIV. (ONTARIO). DEPT. OF EARTH SCIENCES.
The Carbon Isotope Geochemistry of a Small Groundwater System in Northeastern Ontario,
W79-04746 2K

WATERLOO UNIV. (ONTARIO). DEPT. OF SYSTEMS DESIGN.
Comparison of Alternative Engineering Designs,
W79-04690 6A

WEST VIRGINIA UNIV., MORGANTOWN. DEPT. OF POLITICAL SCIENCE.
Speculative Policy Making in the Environmental Arena,
W79-04613 6E

WESTINGHOUSE RESEARCH LABS, PITTSBURGH, PA.
Reverse Osmosis Membranes Containing Graphitic Oxide,
W79-04665 3A

WESTLANDS WATER DISTRICT, FRESNO, CA.
Financing Regional Drainage Facilities Under 1978 Economic Conditions,
W79-04911 5G

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON.
Lake Sturgeon Populations, Growth, and Exploitation in Lakes Poygan, Winneconne, and Lake Butte Des Morts, Wisconsin,
W79-04755 6G

WISCONSIN UNIV.-MADISON.
Energy and Mass Transfer in Partial-Pressure Distillation,
W79-04940 3A

WISCONSIN UNIV.-MADISON. DEPT. OF FORESTRY.
A Policy-Oriented Simulation Model of Debris Production from a Chaparral-Covered Watershed,
W79-04967 6A

WISCONSIN UNIV.-SUPERIOR. DEPT. OF BIOLOGY.
Influence of Turbidity on Fish Abundance in Western Lake Superior,
W79-04532 5C

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA.
Variability in Zooplankton Biomass Distribution in the Northern Sargasso Sea: The Contribution of Gulf Stream Cold Core Rings,
W79-04769 5C

WUERZBURG UNIV. (GERMANY, F.R.). BOTANISHCHES INST. II.
Synchronized Culture of the Halotolerant Unicellular Green Alga Dunaliella parva,
W79-04780 5C

WYOMING UNIV., LARAMIE. WATER RESOURCES RESEARCH INST.; AND WYOMING UNIV., LARAMIE. COLL. OF LAW.
Water Law - Rights of Importers and Developers of Water. City and County of Denver v. Fulton Irrigating Ditch Co., 506 P.2d 144 (Colo. 1972),
W79-04594 6E

Legal Problems in Changing Uses or Coordinating Uses of Keyhole Reservoir,
W79-04595 6E

YAMAGUCHI PREFECTURAL RESEARCH INST. OF HEALTH (JAPAN).
Contents of Total Mercury, Alkyl Mercury, and Methyl Mercury in Some Coastal Fish and Shells,
W79-04589 5A

YAMANASHI UNIV., KOFU (JAPAN). DEPT. OF ENVIRONMENTAL ENGINEERING.
Effect of Enrichment with Digested Night Soi on the Growth of Marine Plankton (In Japanese),
W79-04626 5E

YORK UNIV., TORONTO (ONTARIO). DEPT. OF GEOGRAPHY.
Factors Affecting the Export of Nitrate-Nitrogen from Drainage Basins in Southern Ontario
W79-04735 5E

ZOOLOGISK MUSEUM, COPENHAGEN (DENMARK).
Life Cycles and Population Dynamics of Marine Benthic Bivalves from the Disko Bugt Area o West Greenland,
W79-04767 5C

ACCESSION NUMBER INDEX

W79-04501	5D	W79-04584	5B	W79-04667	3A	W79-04750	2J
W79-04502	6F	W79-04585	2A	W79-04668	5C	W79-04751	2G
W79-04503	6E	W79-04586	6B	W79-04669	3A	W79-04752	2F
W79-04504	5C	W79-04587	5A	W79-04670	3A	W79-04753	2F
W79-04505	5F	W79-04588	5A	W79-04671	3A	W79-04754	5D
W79-04506	2H	W79-04589	5A	W79-04672	3A	W79-04755	6G
W79-04507	6E	W79-04590	5D	W79-04673	3A	W79-04756	4D
W79-04508	5C	W79-04591	5B	W79-04674	3A	W79-04757	6C
W79-04509	5C	W79-04592	5C	W79-04675	3A	W79-04758	3F
W79-04510	5F	W79-04593	5B	W79-04676	3A	W79-04759	6D
W79-04511	3A	W79-04594	6E	W79-04677	3A	W79-04760	6B
W79-04512	3A	W79-04595	6E	W79-04678	3A	W79-04761	6B
W79-04513	3A	W79-04596	7B	W79-04679	3A	W79-04762	6B
W79-04514	3A	W79-04597	5D	W79-04680	6E	W79-04763	5C
W79-04515	3A	W79-04598	3D	W79-04681	6A	W79-04764	5C
W79-04516	3A	W79-04599	5E	W79-04682	5B	W79-04765	5C
W79-04517	3A	W79-04600	5C	W79-04683	3F	W79-04766	5C
W79-04518	3A	W79-04601	5C	W79-04684	2H	W79-04767	5C
W79-04519	3A	W79-04602	2G	W79-04685	3F	W79-04768	5C
W79-04520	3A	W79-04603	2K	W79-04686	6A	W79-04769	5C
W79-04521	3A	W79-04604	2A	W79-04687	6A	W79-04770	5C
W79-04522	6B	W79-04605	3F	W79-04688	6A	W79-04771	5C
W79-04523	6B	W79-04606	2I	W79-04689	6D	W79-04772	5C
W79-04524	6A	W79-04607	2D	W79-04690	6A	W79-04773	5C
W79-04525	6B	W79-04608	2I	W79-04691	6A	W79-04774	5C
W79-04526	6B	W79-04609	5B	W79-04692	6A	W79-04775	5C
W79-04527	6B	W79-04610	6B	W79-04693	3C	W79-04776	5C
W79-04528	5D	W79-04611	6E	W79-04694	5A	W79-04777	5C
W79-04529	5D	W79-04612	6A	W79-04695	6A	W79-04778	5C
W79-04530	5C	W79-04613	6E	W79-04696	5A	W79-04779	5C
W79-04531	5C	W79-04614	5F	W79-04697	5A	W79-04780	5C
W79-04532	5C	W79-04615	5F	W79-04698	6C	W79-04781	5C
W79-04533	5C	W79-04616	6A	W79-04699	6B	W79-04782	5C
W79-04534	5C	W79-04617	5B	W79-04700	6A	W79-04783	5C
W79-04535	5C	W79-04618	6F	W79-04701	6A	W79-04784	5C
W79-04536	5C	W79-04619	5B	W79-04702	6B	W79-04785	5C
W79-04537	5C	W79-04620	6B	W79-04703	5A	W79-04786	5C
W79-04538	5C	W79-04621	5B	W79-04704	5D	W79-04787	5C
W79-04539	5C	W79-04622	5B	W79-04705	5D	W79-04788	2A
W79-04540	5C	W79-04623	5B	W79-04706	2G	W79-04789	2E
W79-04541	5C	W79-04624	5B	W79-04707	3F	W79-04790	7C
W79-04542	5C	W79-04625	4A	W79-04708	3F	W79-04791	7C
W79-04543	5C	W79-04626	5B	W79-04709	6A	W79-04792	7C
W79-04544	5C	W79-04627	2I	W79-04710	5B	W79-04793	1B
W79-04545	5C	W79-04628	5C	W79-04711	6B	W79-04794	5B
W79-04546	5C	W79-04629	5C	W79-04712	5A	W79-04795	7C
W79-04547	5C	W79-04630	5D	W79-04713	5D	W79-04796	6D
W79-04548	5C	W79-04631	5D	W79-04714	6B	W79-04797	7C
W79-04549	5C	W79-04632	5D	W79-04715	5E	W79-04798	7C
W79-04550	5C	W79-04633	5D	W79-04716	5F	W79-04799	7C
W79-04551	5C	W79-04634	7B	W79-04717	6A	W79-04800	5B
W79-04552	5C	W79-04635	5D	W79-04718	6D	W79-04801	2E
W79-04553	5C	W79-04636	5A	W79-04719	2B	W79-04802	7C
W79-04554	5D	W79-04637	5D	W79-04720	7C	W79-04803	7B
W79-04555	6E	W79-04638	5C	W79-04721	5B	W79-04804	4A
W79-04556	5D	W79-04639	3C	W79-04722	5B	W79-04805	6A
W79-04557	2F	W79-04640	5D	W79-04723	8B	W79-04806	2H
W79-04558	2H	W79-04641	5D	W79-04724	4D	W79-04807	5B
W79-04559	5C	W79-04642	5D	W79-04725	2E	W79-04808	6A
W79-04560	5C	W79-04643	5D	W79-04726	2L	W79-04809	7C
W79-04561	5C	W79-04644	5D	W79-04727	2L	W79-04810	5E
W79-04562	2J	W79-04645	5D	W79-04728	2L	W79-04811	7B
W79-04563	2J	W79-04646	5D	W79-04729	2L	W79-04812	2E
W79-04564	2G	W79-04647	6B	W79-04730	2L	W79-04813	6A
W79-04565	5B	W79-04648	5B	W79-04731	5B	W79-04814	2H
W79-04566	5B	W79-04649	5B	W79-04732	5B	W79-04815	5C
W79-04567	5B	W79-04650	2G	W79-04733	2B	W79-04816	5C
W79-04568	5B	W79-04651	5B	W79-04734	1A	W79-04817	5C
W79-04569	5B	W79-04652	5A	W79-04735	5B	W79-04818	5C
W79-04570	5A	W79-04653	3F	W79-04736	2E	W79-04819	5C
W79-04571	5B	W79-04654	5B	W79-04737	2F	W79-04820	5C
W79-04572	8C	W79-04655	5B	W79-04738	2E	W79-04821	5C
W79-04573	8B	W79-04656	5B	W79-04739	2G	W79-04822	5C
W79-04574	8D	W79-04657	5C	W79-04740	2G	W79-04823	5C
W79-04575	2F	W79-04658	5B	W79-04741	2E	W79-04824	5D
W79-04576	7C	W79-04659	5G	W79-04742	2E	W79-04825	5A
W79-04577	4A	W79-04660	6E	W79-04743	2F	W79-04826	5C
W79-04578	7B	W79-04661	5B	W79-04744	2G	W79-04827	5C
W79-04579	3B	W79-04662	2G	W79-04745	7B	W79-04828	5C
W79-04580	4B	W79-04663	6G	W79-04746	2K	W79-04829	5C
W79-04581	5D	W79-04664	3A	W79-04747	2B	W79-04830	5D
W79-04582	2L	W79-04665	3A	W79-04748	2F	W79-04831	5C
W79-04583	2D	W79-04666	3A	W79-04749	2G	W79-04832	5C

W79-04833	5C
W79-04834	5C
W79-04835	5C
W79-04836	5C
W79-04837	5C
W79-04838	5C
W79-04839	2B
W79-04840	5B
W79-04841	5B
W79-04842	5B
W79-04843	5B
W79-04844	5A
W79-04845	5A
W79-04846	5A
W79-04847	5B
W79-04848	5A
W79-04849	5A
W79-04850	5A
W79-04851	5C
W79-04852	5D
W79-04853	6B
W79-04854	2E
W79-04855	2E
W79-04856	5G
W79-04857	4A
W79-04858	6B
W79-04859	2F
W79-04860	2E
W79-04861	2E
W79-04862	6B
W79-04863	2E
W79-04864	2E
W79-04865	2E
W79-04866	2E
W79-04867	6B
W79-04868	6E
W79-04869	6B
W79-04870	2F
W79-04871	6B
W79-04872	4A
W79-04873	4A
W79-04874	2F
W79-04875	3F
W79-04876	6B
W79-04877	5A
W79-04878	2E
W79-04879	5B
W79-04880	5B
W79-04881	5B
W79-04882	5G
W79-04883	5D
W79-04884	5F
W79-04885	5F
W79-04886	5D
W79-04887	3A
W79-04888	5D
W79-04889	5D
W79-04890	5D
W79-04891	5G
W79-04892	5D
W79-04893	5D
W79-04894	5D
W79-04895	5D
W79-04896	5D
W79-04897	5A
W79-04898	3A
W79-04899	5C
W79-04900	5C
W79-04901	2A
W79-04902	5C
W79-04903	2B
W79-04904	5C
W79-04905	5G
W79-04906	4B
W79-04907	5G
W79-04908	5G
W79-04909	5G
W79-04910	5G
W79-04911	5G
W79-04912	8A
W79-04913	3F
W79-04914	4A
W79-04915	4A
W79-04916	4A
W79-04917	2J
W79-04918	2J
W79-04919	5B
W79-04920	5B
W79-04921	5B
W79-04922	6E
W79-04923	2E
W79-04924	5E
W79-04925	5E
W79-04926	5E
W79-04927	5E
W79-04928	5C
W79-04929	5B
W79-04930	5E
W79-04931	5E
W79-04932	4A
W79-04933	5E
W79-04934	5E
W79-04935	3A
W79-04936	3A
W79-04937	3A
W79-04938	3A
W79-04939	3A
W79-04940	3A
W79-04941	3A
W79-04942	3A
W79-04943	3A
W79-04944	3A
W79-04945	3A
W79-04946	3A
W79-04947	3A
W79-04948	3A
W79-04949	3A
W79-04950	2L
W79-04951	1A
W79-04952	3A
W79-04953	3A
W79-04954	3A
W79-04955	3A
W79-04956	5A
W79-04957	4B
W79-04958	5C
W79-04959	6E
W79-04960	3F
W79-04961	4B
W79-04962	6G
W79-04963	5B
W79-04964	3B
W79-04965	6B
W79-04966	6E
W79-04967	6A
W79-04968	5A
W79-04969	5A
W79-04970	5A
W79-04971	5B
W79-04972	5C
W79-04973	5B
W79-04974	5C
W79-04975	5A
W79-04976	5A
W79-04977	5D
W79-04978	3F
W79-04979	8G
W79-04980	3F
W79-04981	3F
W79-04982	3F
W79-04983	8G
W79-04984	3D
W79-04985	5G
W79-04986	4B
W79-04987	2G
W79-04988	2D
W79-04989	4B
W79-04990	3F
W79-04991	3F
W79-04992	2G
W79-04993	2G
W79-04994	2J
W79-04995	3F
W79-04996	3F
W79-04997	3F
W79-04998	4B
W79-04999	3F
W79-05000	5B

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W79-04605--04608 04648--04650 04653--04662 04905--04921 04977--05000	58
Cornell University, Policy Models for Water Resources Systems	W79-04609--04616 04618 04686--04693 04695 04697--04702 04704--04705 04709--04718 04789	37
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W79-04596--04598	3
Illinois State Water Survey Hydrology	W79-04562--04576 04590, 04599 04602--04604 04719--04722 04724--04750 04752--04753 04814, 04839 04843, 04859 04870, 04878 04901, 04903 04950	62
Institute of Paper Chemistry, Water Pollution from Pulp and Paper Industry	W79-04534, 04561 04581 04630--04646 04668	21
National Water Well Association, Water Well Construction Technology	W79-04577--04580	4

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE (CONTINUED)		
University of North Carolina Metropolitan Water Resources Planning and Management	W79-04852--04858 04860--04869 04871--04876 04922	24
University of Wisconsin, Eutrophication	W79-04528--04533 04535--04553 04621--04623 04763--04787	53
University of Wisconsin, Water Resources Economics	W79-04522--04527 04620 04756--04757 04759--04762	13
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-04501 04554--04557 04583--04586 04591--04595 04625, 04627 04647 04683--04685 04788 04957--04964 04966--04967	31
C. OTHER		
Army Engineer Waterways Experiment Station	W79-04923--04934	12
BioSciences Information Service	W79-04703 04706--04708 04723, 04751 04758	7

ABSTRACT SOURCES

OURCE	ACCESSION NUMBER	TOTAL
. OTHER (CONTINUED)		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-04587--04589 04600--04601 04617, 04619 04624, 04626 04628--04629 04651--04652 04694, 04696 04815--04838 04840--04842 04844--04851 04877 04879--04881 04968--04976	63
Information Planning Associates, Inc.	W79-04502--04521 04663--04667 04669--04682 04935--04949 04951--04956	60
National Oceanic and Atmospheric Administration	W79-04582	1
Ocean Engineering Information Service (Patents)	W79-04882--04898	17
Ocean Engineering Information Service (Outer Continental Shelf)	W79-04559--04560 04899--04900 04902, 04904	6
Office of Water Research and Technology	W79-04754, 04965	2
U. S. Geological Survey	W79-04790--04813	24
University of Massachusetts (Wetlands)	W79-04558	1

☆U.S. GOVERNMENT PRINTING OFFICE: 1979-281-061/22

CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Illinois State Water Survey.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

Supported by the Environmental Protection Agency in cooperation with WRSIC

- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

0 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

U.S. MAIL

POSTAGE AND FEES PAID
U S DEPARTMENT OF COMMERCE
COM 211

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OFFICIAL BUSINESS

PRINTED MATTER

AN EQUAL OPPORTUNITY EMPLOYER

John Littlewood
Documents Division
220 D Library
Champaign, IL 61820

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, U.S., and Mexico please use this price schedule; other addressees write for Folder PR-360-4.

A01	$3.00	E01	$3.25	T01	$110.00
A02	4.00	E02	4.75	T02	125.00
A03	4.50	E03	6.25	T03	175.00
A04	5.25	E04	7.50	T04	250.00
A05	6.00	E05	9.00	T05	300.00
A06	6.50	E06	10.50	T06	350.00
A07	7.25	E07	12.50	T07	400.00
A08	8.00	E08	15.00	T08	450.00
A09	9.00	E09	17.50	T09	500.00
A10	9.25	E10	20.00	T10	550.00
A11	9.50	E11	22.50	T11	600.00
A12	10.75	E12	25.00	T12	650.00
A13	11.00	E13	28.00	T13	675.00
A14	11.75	E14	31.00	T14	750.00
A15	12.00	E15	34.00	T15	800.00
A16	12.50	E16	37.00	T16	850.00
A17	13.00	E17	40.00	T17	900.00
A18	13.25	E18	45.00	T18	950.00
A19	14.00	E19	50.00	T19	1,000.00
A20	14.50	E20	60.00	T99	*
A21	15.00	E99	*		
A22	15.25				
A23	15.50	N01	28.00		
A24	16.25	N02	50.00		
A25	16.50				
A99	*				

*Contact NTIS for price quote

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 11
JUNE 1, 1979

W79-05001--W79-05500
CODEN:SWRABW

SELECTED WATER RESOURCES ABSTRACTS is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce, for the Water Resources Scientific Information Center (WRSIC).

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Manager, Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior, Washington, DC 20240.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is attached to the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are: SWRA Journal only, $75; Journal and Annual Indexes, $100; Indexes only, $50. Other addressees, write for prices.

SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 11
JUNE 1, 1979

W79-05001--W79-05500

Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

NUMERICAL MODELING OF LIQUID GEOTHERMAL SYSTEMS,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. L. Sorey.
Available Supt. of Documents, GPO Washington DC 20402 price $1.50. Geological Survey Professional Paper 1044-D, 1978. 25 p, 23 fig, 5 tab, 23 ref.

Descriptors: *Geothermal studies, *Mathematical models, *Numerical analysis, *Hot springs, *Convection, Thermal water, Heat transfer, Mass transfer, Equations, Evaluation, *Hydrothermal systems.

A mathematical model describing the physical behavior of hot-water geothermal systems is presented. The model consists of a set of coupled partial differential equations for heat and mass transfer in porous media and an equation of state relating fluid density to temperature and pressure. The equations are solved numerically using an integrated finite difference method which can treat arbitrary nodal configurations in one, two, or three dimensions. (Woodard-USGS).
W79-05173

2. WATER CYCLE

2A. General

SIMULATED STREAMFLOW RESPONSE TO POSSIBLE DIFFERENCES IN TRANSPIRATION AMONG SPECIES OF HARDWOOD TREES,
Northeastern Forest Experiment Station, Durham, NH.
C. A. Federer, and D. Lash.
Water Resources Research, Vol. 14, No. 6, p 1089-1097, December 1978. 8 fig, 4 tab, 17 ref.

Descriptors: *Streamflow, *Forest watersheds, *Model studies, Transpiration, Trees, Water vapor, Hardwood, Simulation analysis, Speciation, Forests, Streams, *Simulated streamflow, Leaf development, Annual streamflow.

Possible differences in transpiration among species of hardwood trees were simulated in a hydrologic model, called Brook, to estimate the effects of these differences on monthly and annual streamflow. Brook is a deterministic, lumped-parameter model that simulates streamflow from small, forested watersheds in the eastern United States. The model uses only daily mean temperature and daily precipitation as input. A 4-week difference in timing of leaf development in spring or color change in autumn caused differences of 10-60 mm in simulated annual streamflow. When daily transpiration varied by 20%, differences in simulated streamflow ranged from 15 to 120 mm annually. Differences in root distribution with depth can affect the availability of soil water; varying this availability causes differences in simulated streamflow of 15-60 mm. In all cases, the smaller differences occur when the soil is dry at the times of differing transpiration. On a deep residual soil, the differences in streamflow are spread throughout the year, but on a shallow till soil, the differences are restricted to the months in which there are changes in transpiration. Differences in response among 15 deg north-facing and 15 deg south-facing slopes and a horizontal surface were minor. (Roberts-ISWS)
W79-05018

ESTIMATING DESIGN FLOWS FOR URBAN DRAINAGE,
British Columbia, Vancouver. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-05024

THE DEVELOPMENT OF OVERLAND FLOW IN A TROPICAL RAINFOREST CATCHMENT,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geology.
M. Bonell, and D. A. Gilmour.
Journal of Hydrology, Vol. 39, No. 3/4, p 365-382, December 1978. 4 fig, 4 tab, 29 ref.

Descriptors: *Overland flow, *Forests, *Tropical regions, *Australia, On-site investigations, On-site data collections, Rainfall, Precipitation(Atmospheric), Runoff, Subsurface flow, Rainfall intensity, Precipitation excess, Hydrographs, Hydraulic conductivity, Water table, Soil water, Watersheds(Basins), Hydrology, Analytical techniques.

A preliminary assessment was made of the factors contributing to the rapid response of the discharge hydrograph in a tropical rainforest catchment. Overland and subsurface flows were measured by means of a trough system constructed at the lower end of three sites. Water was led from each trough into a tipping-bucket device with which the number of tips was recorded mechanically using a hay-bale counter and electronically by a digital event recorder. Substantial overland flow occurred at all sites despite the exceedingly high average saturated hydraulic conductivity, k sub s values in the top 20 cm of the soil profile. The highest ratio of overland flow to subsurface flow was associated with a plot having an upslope position. Subsurface flow volumes, however, were higher at the two remaining plots of lower-slope position. This was attributed to the presence of residual rocks in the deeply weathered clays. The occurrence of widespread overland flow was explained by the occurrence of high-intensity rainfalls (particularly during the summer months). Such rainfalls frequently exceed the average k sub s values below 20 cm depth and, therefore, generate a widespread perched water table within the top 20 cm. This causes subsurface flow (particularly on steep slopes) through the highly permeable surface horizon. Additional rain causes the perched water table to emerge at the soil surface and, hence, widespread saturation overland flow results for the remainder of the storm. This overland flow is tapped by a temporary dense drainage network, thus accounting for the rapid quickflow response. Spearman's rank correlation coefficient analysis emphasized the significance of rainfall intensity despite some detailed differences between 'summer' and 'winter' rainfall events. It was concluded that in this particular environment, the variable source area concept of storm flow generation, associated with humid temperate areas, is not applicable mainly due to the characteristics of rainfall intensity. (Sims-ISWS)
W79-05030

MODELING NITROGEN MOVEMENT IN AGRICULTURAL WATERSHEDS,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W79-05069

A MULTIVARIATE MODEL OF STORM-PERIOD SOLUTE BEHAVIOUR,
Exeter Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W79-05144

TRENDS IN STREAMFLOW DUE TO UPSTREAM LAND-USE CHANGES,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
For primary bibliographic entry see Field 2E.
W79-05147

DIGITAL SIMULATION AND EVALUATION OF STORM DRAINAGE SYSTEMS: ST. LOUIS HEIGHTS WATERSHED MODEL,
Hawaii Univ., Honolulu. Water Resources Research Center.
E. Yu-Si Fok, T. Murabayashi, and Sanguan Phamwon.
Technical Report No. 114, November 1977. 138 p, 17 fig, 3 tab, 12 ref, 4 append.

Descriptors: Hydrology, Rainfall, Storms, Urban planning, computer, Computer models, Flood control, Hawaii, Infiltration, Runoff, Watershed.

The adequate design of a storm drainage system depends upon the proper estimation of various peak discharges (produced from a given storm) along the drainage network. The objective of this study is the development of a digital computer model utilizing available hydrologic data obtained during 1972 to 1975 to simulate runoff from given rainfall patterns in Hawaiian urban watersheds, and the development of procedures for channel flow routing through gutters and storm drains and runoff routing from previous and impervious areas. The computer model is the result of using the kinematic wave equation, which is most suitable to steep topographic terrain such as that of the study area, to modify the overland, gutter, and sewer flow routing procedures of the Illinois Urban Drainage Area Simulator (ILLUDAS) model. Available infiltration data were used to modify the infiltration process. Examples of the system capacity design and evaluation, and computer programs for the application of this simulation model are presented for user's adaptation.
W79-05225

OBTAINING VARIATIONS OF FIELD INFILTRATION CAPACITY FROM SIMULATED RAINSTORM EXPERIMENTS (DETERMINATION DES VARIATIONS DE LA CAPACITE D'ABSORPTION D'UN SOL EN PLACE SOUS AVERSES SIMULEES),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France). Hydrology Section.
For primary bibliographic entry see Field 2G.
W79-05257

DEVELOPMENT OF A HYDROLOGIC MODEL FOR A CANADIAN WATERSHED,
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
G. W. Kite.
Canadian Journal of Civil Engineering, Vol. 5, No. 1, p 126-134, March 1978. 4 fig, 2 tab, 15 ref.

Descriptors: *Canada, *Watersheds(Basins), *Parametric hydrology, *Computer models, *Simulation analysis, Optimization, Hydrographs, Snowmelt, Performance, Systems analysis, Magpie River(Ontario).

Three large well-known hydrologic models, the Streamflow Synthesis and Reservoir Regulation, the National Weather Service River Forecast System, and the Saskatchewan River Model No. 6, were calibrated and verified on a 2000 km2 watershed in northern Ontario over two Spring snowmelt periods. Although results were adequate, it was thought that a smaller simpler model could be designed that would give results at least as good with much less expenditure of time, money, and effort. Details of the relative performances of the three existing and one new model are given, and comparative hydrographs are shown. The main interest in developing the simple parametric model was for flood forecasting. Although use of the models on only one basin cannot provide conclusive evidence of the models' relative goodness, the results obtained do show significant differences between the models as well as certain advantages for the new model. (Bell-Graff--Cornell)
W79-05280

URBAN RAINFALL-RUNOFF-QUALITY DATA BASE,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
W. C. Huber, and J. P. Heaney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 065, Price codes: A09 in paper copy, A01 in microfiche.

EPA-600/8-77-009. Prepared for: Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH., July 1977. 166 p, 45 fig, 68 tab, 181 ref. 68-03-0496.

Descriptors: *Rainfall, *Runoff, *Water quality, *Data collections, *Storm sewers, Hydrology, Precipitation, Water pollution, Surveys, Documentation, Data storage and retrieval, Combined sewers, Mathematical models, Surface water runoff, Storms, Urban runoff.

Urban rainfall-runoff-quality data gathered by others have been assembled on a storm event basis for one or more catchments in the following eight cities: San Francisco (Cal.); Broward County (Fla.); Lincoln (Neb.); Durham (N.C.); Windsor (Ont.); Lancaster (Pa.); Seattle (Wash.); and Racine (Wis.). Rainfall-runoff data have been assembled for one or more catchments in an additional 13 cities: Baltimore (Md.); Chicago (Ill.); Champaign-Urbana (Ill.); Bucyrus (Ohio); Fall Church (Va.); Winston-Salem (N.C.); Jackson (Miss.); Wichita (Kan.); Westbury (N.Y.); Philadelphia (Pa.); Los Angeles (Cal.); Portland (Ore.); and Houston (Tex.). The 21 cities contain data for a total of 41 catchments. Descriptions of the catchments, parameters and sampling procedures are provided herein. Actual data have been placed on a magnetic tape and will be placed on the EPA STORET data retrieval system in the future. Additional data for the above cities and data for other cities will be included in the form of addenda to this report. Although none are presently included, data collected as part of current EPA Section 208 Areawide Waste Management studies are expected to augment the data base in the future. (Bell-Graf-Cornell)
W79-05282

2B. Precipitation

RECORD WINTER STORMS IN ILLINOIS, 1977-1978,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr., and D. Changnon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 181, Price codes: A03 in paper copy, A01 in microfiche. Report of Investigation 88, 1978. 26 p, 12 fig, 6 tab, 6 ref.

Descriptors: *Storms, *Winter, *Snow, *Illinois, *Central US, Snowfall, Snow cover, Ice, Blizzards, Winds, Damages, Hazards, Distribution patterns, Precipitation(Atmospheric), Effects, Highways, Temperature, Air temperature, Climatology, Meteorology, *Winter storms, Severe winter storms, Snowstorms, Ice storms, Freezing rain.

The Midwest, including Illinois, experienced in 1977-1978 its most severe winter since weather records began in the early 19th century. The major impact in Illinois came from a record-breaking number of 18 severe winter storms. In a normal year, only 4 storms occur. The record winter began with three snowstorms in late November and ended with an extremely damaging ice storm in late March. Unusual snow patterns occurred with several storms, and they lasted in Illinois much longer than usual. Weather conditions (low pressure centers) producing many of the storms were more often of Canadian origin than usual, and these lows had lower pressure and moved slower than normal, resulting in higher surface winds and longer lasting and hence more severe storms. Cold temperatures coupled with the frequent snowstorms resulted in record long-lasting snow cover with up to 120 days with 1 inch or more cover in northern Illinois and 90 days in southern Illinois. The storms led to deaths of 62 persons and injuries to more than 2,000. Utilities and communication systems suffered great losses due to damage to lines, poles, and towers. Transportation losses included damaged vehicles, delayed shipments, and great delays in bus and airline service; however, railroads benefited with increased usage, and helicopters and snowmobiles proved valuable in rescue service. The local, state, and federal institutions were beset with enormous and costly problems, including care of roads and lost taxable income due to absenteeism. (Sims-ISWS)
W79-05013

THE DEVELOPMENT OF OVERLAND FLOW IN A TROPICAL RAINFOREST CATCHMENT,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geology.
For primary bibliographic entry see Field 2A.
W79-05030

SOME ASPECTS OF FLORIDA CONVECTIVE RAINFALL,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
S. L. Ulanski, and M. Garstang.
Water Resources Research, Vol. 14, No. 6, p 1133-1139, December 1978. 12 fig, 2 tab, 12 ref. NOAA 03-3-022-98, 03-5-022-37, NSF ATM76-14918.

Descriptors: *Rainfall, *Convection, *Florida, Clouds, Fronts(Atmospheric), Networks, Precipitation(Atmospheric), Network design, Thunderstorms, *Convective rainfall, *Dense network, Intensity, Multishower days, Showers, Airmass showers, Convective clouds.

A dense network of rain gages in an area of 660 sq km in south Florida was operated for the summers of 1971 and 1973. More than 3 times as much rain fell in this network in the summer of 1973 as in 1971. The two periods were examined in order to understand the controls in convective rainfall which produced such contrasting amounts. It was found that the total duration and intensity of rain was about the same in both years. Well-organized thunderstorms of large extent accounted for the bulk of the rainfall. These large storms occurred with a greater frequency in 1973 than in 1971. Days with single showers produced more rain than multishower days. The critical variable in determining convective rainfall amount is the size of the individual storm. These large storms appear to eliminate competition for the available moisture supply and are more efficient in converting that moisture to rainfall. (Roberts-ISWS)
W79-05139

CALCITE AS A SOURCE OF EXCESS CALCIUM IN RAINWATER,
Tokyo Inst. of Tech. (Japan). Dept. of Environmental Chemistry.
For primary bibliographic entry see Field 2K.
W79-05262

2C. Snow, Ice, and Frost

RADAR ANISOTROPY OF SEA ICE DUE TO PREFERRED AZIMUTHAL ORIENTATION OF THE HORIZONTAL C AXES OF ICE CRYSTALS,
Army Terrestrial Sciences Center, Hanover, NH. Earth Sciences Branch.
A. Kovacs, and R. M. Morey.
Journal of Geophysical Research, Vol. 83, No. C12, p 6037-6046, December 20, 1978. 6 fig, 2 tab, 36 ref. ONR NR 307-393,NOAA 01-5-022-1651.

Descriptors: *Sea ice, *Radar, *Crystals, Anisotropy, Heterogeneity, Ice, Electrical properties, Currents(Water), Oceans, Cold regions, Arctic, Remote sensing, On-site investigations, Ice c axis.

Results of impulse radar, ice crystal c axis, and subice current measurements on the fast ice near Narwhal Island, Alaska, were presented. The crystal structure of the ice was found to have a horizontal crystal c axis with a preferred azimuthal orientation. This orientation was found to align with the direction of the current at the icewater interface. Impulse radar reflection measurements revealed that the preferred orientation of the sea ice crystal structure behaved as a microwave polarizer. It was observed that when the antenna E field was oriented parallel with the c axis of the crystal platelets, a strong reflection of the radar signal from the bottom of the ice was obtained. However, when the antenna E field was oriented perpendicular to the c axis, no bottom reflection was detected. The results of this study fully support earlier reports of sea ice inhomogeneity and anisotropy in reference to both structure and electromagnetic energy transmission. (Sims-ISWS)
W79-05138

SNOW-COVERED AREA UTILIZATION IN RUNOFF FORECASTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
A. Rango, J. F. Hannaford, R. L. Hall, M. Rosenzweig, and A. J. Brown.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, Proceedings Paper 14326, p 53-66, January 1979. 5 fig, 3 tab, 4 ref. NASA NAS5-22957.

Descriptors: *Aerial photography, *Aircraft, *California, Forecasting, Remote sensing, Runoff, Satellites(Artificial), Runoff forecasting, Snow, Snow cover, Water resources, *Sierra Nevada Mountains, *Kern River Watershed, *Kings River Watershed, Long-term data, Satellite observations, Melt season.

Long-term data on snow-covered area from aircraft and satellite observations were investigated for application to water-supply forecasting in California's southern Sierra Nevada Mountains. These observations proved useful in reducing seasonal runoff forecast error on the Kern River watershed when incorporated into procedures to update water-supply forecasts as the melt season progressed. Similar use of snow-covered area on the Kings River watershed produced results that were about equivalent to methods based solely on conventional data. Snow-covered area was most effective in reducing forecast procedural error on an erratic precipitation or snowpack accumulation pattern, or both, not strongly related to elevation; and poor coverage by precipitation stations or snow courses restricted adequate indexing of water-supply conditions. When satellite data acquisition and delivery problems were resolved, the derived snow-cover information should provide a means for enhancing operational streamflow forecasts. (Roberts-ISWS)
W79-05140

MELTING OF A PRAIRIE SNOWPACK,
Saskatchewan Univ., Saskatoon. Div. of Hydrology.
R. J. Granger, and D. H. Male.
Journal of Applied Meterology, Vol. 17, No. 12, p 1833-1842, December 1978. 13 fig, 2 tab, 22 ref.

Descriptors: *Melting, *Snowpacks, *Snowmelt, *Canada, Grasslands, Snow cover, Energy budget, Energy transfer, On-site investigation, Instrumentation, On-site data collections, Data processing, Mathematical models, Temperature, Thawing, Runoff, Melt water, Prairie snowpacks.

An energy budget approach was used to study the melt of a prairie snowpack. Air temperature, humidity, and wind speed were measured at 7 levels in the first 2 m above the snow surface. Evaporation and melt were measured directly with a weighing lysimeter which enables all the terms of the energy budget to be determined independently. On the basis of results from 3 spring melt periods, the net radiation flux is shown to be the major source of energy for the melt periods, the net radiation flux is shown to be the major source of energy for the melt of a continuous snowcover. In the absence of local advection, the sensible heat flux is shown to be a function of the energy content of the air mass and more closely related to the 850 mb temperature than to temperatures near the snow surface. The latent heat flux responds to the radiation flux with daytime evaporation and nighttime condensation; however, the net daily flux is usually evaporative. (Sims-ISWS)
W79-05252

THE APPLICABILITY OF DUAL GAMMA SCANNING TO FREEZING SOILS AND THE PROBLEM OF STRATIFICATION,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
J. B. Goit, P. H. Groenevelt, B. D. Kay, and J. G. P. Loch.
Soil Science Society of American Journal, Vol. 42, No. 6, p 858-863, November-December 1978. 6 fig, 10 ref.

Descriptors: *Frozen soils, *Nuclear moisture meters, *Moisture content, Freezing, Instrumentation, Moisture meters, Soils, Density, Stratification, Ice, Soil water, Gamma rays, Nuclear meters, Soil science, Dual gamma scanning.

The attenuation of a dual energy gamma beam provides a powerful technique for studying the swelling phenomenon associated with soil freezing. However, the development of a stratified system due to the formation of a discrete ice lens in the same plane as the gamma beam requires special attention. Erroneous results are obtained when attenuation equations which are developed for homogeneous mixtures are applied to stratified media. The calculated dry bulk densities are then always lower than the averaged actual dry bulk densities and sometimes even negative. The calculated water contents are then always higher than the averaged actual water contents and sometimes in excess of 1 g/cu cm. Stratification also may occur during the shrinking of unfrozen soil when cracks form in the same plane as the gamma beam. The equation describing the attenuation of a gamma beam in a stratified medium was formulated. A technical modification in the scanning procedure was suggested in order to solve the appropriate equations and to locate the interface. (Sims-ISWS)
W79-05260

A MODEL STUDY OF ST. MARYS RIVER ICE NAVIGATION,
Acres International Ltd., Niagara Falls (Ontario).
J. E. Cowley, J. W. Hayden, and W. W. Willis.
Canadian Journal of Civil Engineering, Vol. 4, No. 3, p 380-391, September 1977. 10 fig.

Descriptors: *Hydraulic models, *Model studies, *Ice cover, *Navigation, Winter, Lake Superior, Lake Huron, Canada, Great Lakes, United States, Channels, Harbors, Ships, Simulation analysis, Temperature, Effects, Systems analysis.

Ice conditions on the St. Marys River hamper winter navigation between Lake Superior and Lake Huron. Vessel movements in the river during winter months lead to changes in the river ice regime and affect local ferry service across the river. A hydraulic scale model of a 7300-m length of the waterway extending downstream from the Soo Locks was used to compare alternatives for relieving these effects. Methods for representing ice behavior were a key element in the model study. An arrangement of ice booms with an open ship passage which does not impede navigation was developed and recommended on the basis of model tests. That boom arrangement was installed at the end of 1975 and proved to be highly effective under the ice conditions experienced in the 1975-1976 and 1976-1977 winter seasons. (Bell-Graf--Cornell)
W79-05278

COMPUTER SIMULATION OF BUBBLER-INDUCED MELTING OF ICE COVERS USING EXPERIMENTAL HEAT TRANSFER RESULTS,
Northwestern Univ., Evanston, IL. Dept. of Mechanical Engineering.
R. Keribar, R. S. Tankin, and G. D. Tan.
Canadian Journal of Civil Engineering, Vol. 5, No. 3, p 362-366, September 1978. 4 fig, 1 tab, 9 ref.

Descriptors: *Simulation analysis, *Ice cover, *Heat transfer coefficients, *Bubbler systems, *Melting, Computers, Winter, Water bodies, Deep water, Behavior, Performance, Temperature, Equations, Thickness, Prediction, Finite difference method, Weather data, Site characteristics, Systems analysis.

After a brief description of the physical phenomenon associated with artificial suppression of winter ice sheets over water bodies by 'Bubbler systems' or submerged air injectors, results of laboratory experiments conducted to determine bubbler-induced heat transfer coefficients are reported. Implications and validity of results are discussed. As a second step, a procedure for computer-simulating the behavior of an ice sheet whose thickness is controlled by a bubbler system operating intermittently over a long period of time is developed. The simulation uses experimentally determined bubbler heat transfer coefficients, weather data, site characteristics, and desired performance as input data, and a finite difference method to solve the equations governing the ice thickness and temperature profile. Through an example simulation, the usefulness of the procedure in predicting ice thickness and temperature profile histories and the effectiveness or suitability of a given bubbler system are demonstrated. (Bell-Graf--Cornell)
W79-05279

2D. Evaporation and Transpiration

SIMULATED STREAMFLOW RESPONSE TO POSSIBLE DIFFERENCES IN TRANSPIRATION AMONG SPECIES OF HARDWOOD TREES,
Northeastern Forest Experiment Station, Durham, NH.
For primary bibliographic entry see Field 2A.
W79-05018

RUNOFF CURVE NUMBERS WITH VARYING SITE MOISTURE,
Utah State Univ., Logan. Dept. of Forestry and Outdoor Recreation.
R. H. Hawkins.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR4, Proceedings Paper 14254, p 389-398, December 1978. 5 fig, 3 tab, 4 ref, 2 append.

Descriptors: *Soil moisture, *Runoff coefficient, *Antecedent moisture content, *Infiltration, Rainfall, Evapotranspiration, Drainage, Runoff, Equations, Mathematical studies, Storms, *Runoff curve numbers, Soil conservation service.

Runoff curve numbers are used to estimate runoff from storm rainfall. These numbers are usually modified by handbook methods to account for the influence of watershed wetness. An alternate technique, based on the Soil Conservation Service (SCS) rainfall runoff formula and conservation of mass, was developed. The methodology requires inputs of the interim evapotranspiration and drainage, but it is not unreasonably sensitive to estimates. The relationships derived may be used, with judgment, as an alternate to handbook methods. (Singh-ISWS)
W79-05023

2E. Streamflow and Runoff

WEAR OF UNSOUND PEBBLES IN RIVER HEADWATERS,
Cornell Univ., Ithaca, NY. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W79-05016

RELATIONSHIP BETWEEN ALLUVIAL SOILS AND FLOODING IN THE PIEDMONT LOWLAND OF SOUTHEASTERN PENNSYLVANIA,
Pennsylvania Univ., Philadelphia. Dept. of Landscape Architecture and Pennsylvania Univ., Philadelphia. Regional Planning Div.
H. Price, and A. Johnson.
Water Resources Research, Vol. 14, No. 6, p 1189-1194, December 1978. 7 fig, 17 ref.

Descriptors: *Floods, *Flood frequency, *Soils, *Alluvial channels, *Pennsylvania, Alluvium, Soil types, Flood forecasting, Flood recurrence interval, Regression analysis, Flood plain zoning, Flood plains, Planning, Probability, Data processing, Analytical techniques, Flood plain soils.

Regressions of 50- and 100-year synthetic flood widths on widths of alluvial soils bordering the stream were computed with confidence intervals for data from streams in the Piedmont Lowland of southeastern Pennsylvania. These intervals were too wide to recommend use of alluvial soils in floodplain zoning in this gently rolling terrain. A rule of thumb of 2 1/2 times the alluvial soils width was suggested for safe location of land uses for which flooding would be intolerable. Data for one of the minor soils indicated that some soils may delineate flood hazard areas better than others, but too few data were available for complete analysis. (Sims-ISWS)
W79-05017

SIMULATED STREAMFLOW RESPONSE TO POSSIBLE DIFFERENCES IN TRANSPIRATION AMONG SPECIES OF HARDWOOD TREES,
Northeastern Forest Experiment Station, Durham, NH.
For primary bibliographic entry see Field 2A.
W79-05018

BEHAVIOUR OF A HYDRODYNAMIC FINITE ELEMENT MODEL,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-05020

RUNOFF CURVE NUMBERS WITH VARYING SITE MOISTURE,
Utah State Univ., Logan. Dept. of Forestry and Outdoor Recreation.
For primary bibliographic entry see Field 2D.
W79-05023

ESTIMATING DESIGN FLOWS FOR URBAN DRAINAGE,
British Columbia, Vancouver. Dept. of Civil Engineering.
S. O. Russell, B. F. I. Kenning, and G. J. Sunnell.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, Proceedings Paper 14317, p 43-52, January 1979. 2 fig, 1 tab, 14 ref, 1 append.

Descriptors: *Drainage, *Model studies, *Canada, Hydraulic models, Peak discharge, Flow, Storm runoff, Storm water, Estimating, Urbanization, Urban drainage, *Peak runoff.

As an area urbanizes, peak runoff tends to increase. But the effects of urbanization on storm flows can be offset by a policy of requiring detention storage. A new method for computing design flows and storage volumes was developed to prepare a master drainage plan for a municipality in Western Canada. The method involves use of a hydrologic model to analyze all the significant storms of record over the range of parameter values likely to apply in the area, a frequency analysis of the compound peaks, storage of the results in a large matrix in a computer, and subsequent interpolation of the stored data. By inputting estimated values of the parameters for any particular basin, the user can obtain peak flows for any desired return period and also the amount of detention storage required. Parameters can be specified either with single values or by ranges, taking into account parameter uncertainty. (Lee-ISWS)
W79-05024

SIZING OF RESERVOIRS FOR PERIODIC-STOCHASTIC INPUT AND PERIODIC OUTPUT,
Engineering Consultants, Inc., Denver, CO.
For primary bibliographic entry see Field 2H.

W79-05029

THE DEVELOPMENT OF OVERLAND FLOW IN A TROPICAL RAINFOREST CATCHMENT,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geology.
For primary bibliographic entry see Field 2A.
W79-05030

DIGITAL SIMULATION OF SNOWMELT RUNOFF,
Nevada Univ. System, Reno. Water Resources Center.
R. G. Merritt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 252, Price codes: A06 in paper copy, A01 in microfiche. Publication No 41055, April 1978. 107 p, 20 fig, 2 tab, 20 ref. OWRT A-076-NEV(1). 14-34-0001-7060.

Descriptors: *Snowmelt, Dewpoint temperature, Computer programs, Runoff, Simulation.

A computer program was developed for snowmelt runoff simulation. The program utilized the physical equations presented in SNOW HYDROLOGY (Corps of Engineers, U.S. Army, 1956) describing heat budget components involved in snowmelt. The model requires initial snow depth and water equivalent estimates, along with continuous air temperature, dewpoint temperature, wind speed ahd shortwave and longwave radiation readings as input. If radiation observations are unavailable, the model will estimate missing components. Results show that an improved meteorologic data base is required to gain acceptable snowmelt runoff simulation with the model. (Smith-Nevada)
W79-05091

CHARACTERISTICS OF THE OSWEGO RIVER PLUME AND ITS INFLUENCE ON THE NEARSHORE ENVIRONMENT,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
G. L. Bell.
NOAA Technical Memorandum ERL GLERL-22, October 1978. 85 p, 55 fig, 8 tab, 19 ref. Also as Great Lakes Environmental Research Laboratory Contribution No. 163.

Descriptors: *Rivers, *Lakes, *Sediments, Water pollution, Streamflow, Suspended solids, Dredging, Water pollution sources, Lake Ontario, Nearshore environment.

Ion and suspended material concentrations were relatively high in the Oswego River as compared to Lake Ontario background levels and generally decreased rapidly through Oswego Harbor. There were indications of loading of nutrients, chloride, chemical oxygen demand, and volatiles other than from the river. However, oxygen depletion was not a problem in any area. Transmissometer profiles were used to supplement the chemical and temperature data. They conventionally detail the plume structure. Plume configurations varied in response to stream flow, prevailing longshore currents, and current variations related to changes in wind direction and velocity. Suspended materials varied with river flow. During low flow periods these materials are deposited in the harbor on either side of the channel and in the plume area adjacent to the harbor. Dredging operations resuspend some materials, which are then redistributed. Dredged spoil deposited offshore produces an additional impact on the deeper portion of the lake. The combined effects of longshore and wave generated currents tend to keep the materials moving. Movement of fine particulates over a thermocline surface provides a mechanism by which these materials are kept in suspension and widely distributed. (NOAA)
W79-05118

FLOW RESISTANCE OF LARGE-SCALE ROUGHNESS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. C. Bathurst.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14239, p 1587-1603, December 1978. 8 fig, 3 tab, 21 ref, 2 append.

Descriptors: *Channels, *Flow resistance, *Roughness(Hydraulic), Hydraulics, Resistance, Sediments, Velocity, Rivers, Drag, Boulders, *England, *River Tees(England), Boundary shear, Velocity distribution.

A theory of the resistance to flow in rivers with large-scale roughness was developed, and a resistance equation was constructed using data from the upper River Tees, England. The theoretical analysis showed that, in channels with large values of relative roughness, resistance to flow depends mainly on the size, shape, spacing, and size distribution of the boundary roughness elements. Channel geometry is important only in its effect on the drag of the elements. This theory was illustrated using data from field sites at which roughness shape and size distribution were similar and roughness spacing could be directly related to relative roughness. In the resistance equation (which is specific to the field sites), the resistance coefficient varies with just relative roughness and a parameter of channel geometry. (Lee-ISWS)
W79-05141

EXPECTED ASYMPTOTIC MAXIMUM DEFICIT FOR PERIODIC-STOCHASTIC RESERVOIR INFLOWS IN CASE OF PARTIAL FLOW REGULATION,
Engineering Consultants, Inc., Denver, CO.
For primary bibliographic entry see Field 2H.
W79-05145

TRENDS IN STREAMFLOW DUE TO UPSTREAM LAND-USE CHANGES,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
W. V. Pitman.
Journal of Hydrology, Vol. 39, No. 3/4, p. 227-237, December 1978. 10 fig, 4 ref.

Descriptors: *Model studies, *Streamflow, *Land use, Rainfall-runoff relationships, Watersheds(Basins), Hydrology, Effects, Forests, Upstream, Analysis, Equations, Rainfall-runoff models, Non-stationary processes.

Most streamflow records are affected to some degree by changes in man's activities in the catchment. Records displaying trends must be rendered stationary before being subjected to further analysis. With the aid of rainfall-runoff models, not only can non-stationarity be detected, but the cause can be identified and quantified. Moreover, the effects on streamflow of further changes of the type identified can be predicted. The influence of upstream afforestation on streamflow was illustrated by worked examples. (Lee-ISWS)
W79-05147

EVALUATION AND DESIGN OF A STREAMFLOW-DATA NETWORK IN WASHINGTON,
Geological Survey, Reston, VA. Water Resources Div., and Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W79-05159

7-DAY LOW FLOWS AND FLOW DURATION OF ALABAMA STREAMS THROUGH 1973,
Geological Survey, Jacksonville, FL. Water Resources Div.
E. C. Hayes.
Alabama Geological Survey Division of Water Resources Bulletin 113, 1978. 163 p, 1 fig, 2 plates, 5 tab, 9 ref.

Descriptors: *Low flow, *Data collections, *Alabama, *Streams, *Average flow, Flow duration, Gaging stations, Natural flow, Regulated flow, Maps, Flow measurement, Sites.

Estimates for one or both low-flow parameters (annual 7-day low flows with 2-year and 10-year recurrence intervals) are tabulated for 527 locations on 341 different streams in Alabama. Drainage area for these sites range from 1.3 square miles to 43,000 square miles. The average discharge and flow-duration tables were computed for selected period of record at 223 stream-gaging stations on 141 different streams. (Woodard-USGS)
W79-05166

INTERACTING EFFECTS OF MINIMUM FLOW AND FLUCTUATING SHORELINES ON BENTHIC STREAM INSECTS,
Idaho Univ., Moscow. Dept. of Entomology.
M. A. Brusven, and E. F. Trihey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 358, Price codes: A05 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho, Research Technical Completion Report, August 1978. 78 p, 26 fig, 10 tab, 26 ref. OWRT A-052-IDA(1), 14-34-0001-8014.

Descriptors: *Minimum flows, *Benthic habitat, *Aquatic insects, Low flow, Dworshak Dam, Water releases, Clearwater River, Hydroelectric powerplants, Fluctuating flows.

A 50 mile (80 km) reach of the Clearwater River, Idaho was studied from its confluence with the Snake River upstream to Orofino, Idaho. The study examined two important changes in the River: (1) effects of hydropower releases from Dworshak Dam on the aquatic insect community in the free flowing reach of the Clearwater River, and (2) backwater effects of Lower Granite Dam on benthos in the lower five mile (8 km) of the Clearwater River. While small to moderate shifts in seasonal densities of principal species have occurred between intensive study sites above and below the influence of Dworshak Dam, evidence does not indicate these shifts are attributable to hydropower releases. Approximately one month was required for sterile rocks to support a standing crop similar to that of continually watered rocks. Although hydropower releases cause frequent and marked fluctuations in discharge, there is a stable post project low flow. Higher late summer flow guarantees the submergence of additional substrate, thereby increasing macrobenthic habitat. Drift rates and standing crop relationships above and below the influence of Dworshak Dam suggest insects drifted more in response to daily fluctuations than to the factor of bottom density. Formation of Lower Granite reservoir has resulted in insect community shifts from a riverine to a lenthic community.
W79-05233

MIXING OF POWER-PLANT HEATED EFFLUENTS WITH THE MISSOURI RIVER,
Iowa Univ. Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 5B.
W79-05245

FLOOD HAZARD ANALYSES: LITTLE CATOCTIN CREEK AND TRIBUTARIES, FREDERICK COUNTY, MARYLAND.
Soil Conservation Service, College Park, MD.
January 1978. 19 p, 5 fig, 3 tab, 10 ref, 8 append.

Descriptors: *Flood plain zoning, *Flood frequency, *Flood profiles, *Land use, *Maryland, Topography, Soil types, Snowmelt, Hydrology, Tributaries, Streams. *Little Catoctin Creek (MD), *Flood hazard maps, *Frederick County (MD), Flood plain management.

This report contained flood hazard information for the Little Catoctin Creek, a southwestern stream which empties directly into the Potomac River. The watershed lies within the Blue Ridge physiographic province. The soils have moderate infiltration rates and runoff potentials during a flood

vent. Pasture and crops cover 83% of the watershed, and about 17% is under forest cover. An 18.3 mile reach of the creek was studied. The flood of record occured in 1936 due to frontal rains combined with spring snow melt. This flood had a recurrence interval of about 100 years. Flood hazard area maps showing the 500-year and 100-year flood limits and flood profiles of the 500-, 100-, 50-, and 10-year water surfaces along with typical cross sections were included in the report. The information presented will be useful for flood plain management in the watershed. (Singh-ISWS).
W79-05246

EFFECTIVE DEPTH IN CHANNELS HAVING BED UNDULATIONS,
Indian Inst. of Tech., Kharagpur. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-05254

A SIMPLE VERSION OF GUMBEL'S METHOD FOR FLOOD ESTIMATION,
Mosul Univ. (Iraq). Dept. of Civil Engineering.
G. Al-Mashidani, B. B. L. Pande, and M. F. Mujda.
Hydrological Sciences Bulletin, Vol. 23, No. 3, p 373-380, September 1978. 2 fig, 4 tab, 7 ref.

Descriptors: *Floods, *Flood forecasting, *Statistical methods, Statistical models, Mathematical models, Rivers, Streamflow, Flood frequency, Discharge(Water), Runoff, Analytical techniques, Hydrology, Foreign countries, Foreign research, *Gumbel's method, *Iraq.

Gumbel's method was simplified in such a manner that one can obtain the magnitude of a given return period flood without recourse to looking at a table and working out the value of the coefficient of variation of the given data. The results obtained by the simplified version were compared with those obtained from using both the original approach and those from Powell's modification of Gumbel's method. (Sims-ISWS)
W79-05256

INFLUENCE OF ROW SPACING OF GRAIN SORGHUM ON GROUND COVER, RUNOFF, AND EROSION,
Science and Education Administration, Temple, TX. Grassland, Soil and Water Research Lab.
For primary bibliographic entry see Field 3F.
W79-05258

2F. Groundwater

THE SEYMOUR AQUIFER GROUND-WATER QUALITY AND AVAILABILITY IN HASKELL AND KNOX COUNTIES, TEXAS, VOLUME I.
Texas Dept. of Water Resources, Austin.
Report 226, December 1978. 73 p, 56 fig, 10 tab, 80 ref, 1 append.

Descriptors: *Aquifers, *Groundwater resources, *Data collections, *Texas, *Water quality, Groundwater availability, Pumping, Specific capacity, Transmissivity, Zone of saturation, Groundwater movement, Water level fluctuations, Nitrates, Dissolved solids, Sulfates, Chlorides, Hardness(Water), Water pollution sources, Oil wells, Water wells, Oil wastes, Hydrogeology, *Haskell County(TX), *Knox County(TX), *Seymour aquifer, Saturated thickness.

This two volume report described the groundwater resources of the Seymour aquifer in Haskell and Knox Counties, Texas. Emphasis was on water quality, but important availability information was included. The primary objective of the investigation was to gain a comprehensive understanding of: (1) the water quality in the Seymour aquifer; (2) the past, present, and potential sources of pollution to the aquifer due primarily to mineralized water; and, (3) the future quality and availability of water from the aquifer. Volume I contained text and related illustrations and tables describing the quality and quantity of the groundwater resources of the Seymour aquifer. It included an explanation of the geology as related to the occurrence of groundwater, the groundwater conditions in the Seymour, groundwater in other formations, and pollution in the Seymour. Provided was information intended to aid in obtaining maximum benefits from the Seymour aquifer and to assist regulatory agencies in protecting the aquifer from pollution. Volume II contained supporting basic data consisting of maps and tables. The Seymour aquifer is the only source of moderate-to-large supplies of fresh groundwater within the area. No alternative fresh supplies exist from deeper formations. The aquifer underlies 274,500 acres and furnishes water to over 2,000 irrigation wells. Municipal, domestic, and stock supplies are also dependent on the Seymour. (See also W79-05015) (Humphreys-ISWS)
W79-05014

THE SEYMOUR AQUIFER GROUND-WATER QUALITY AND AVAILABILITY IN HASKELL AND KNOX COUNTIES, TEXAS, VOLUME II.
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-05015

DISTRIBUTED SOURCES FOR UNCONFINED GROUNDWATER FLOW IN A HALF-SPACE,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
O. D. L. Strack.
Journal of Hydrology, Vol. 39, No. 3/4, p 239-253, December 1978. 7 fig, 10 ref, 1 append.

Descriptors: *Aquifers, *Groundwater movement, *Mathematical models, *Equations, Water table aquifers, Drains, Homogeneity, Theoretical analysis, Water table, Saturated flow, Model studies, Conformal mapping, Boundary integrals.

The exact solution to a problem of unconfined saturated flow of groundwater in a semi-infinite homogeneous and isotropic permeable medium was presented. The inflow and outflow occur along an arbitrary number of segments of the phreatic surface. The inflow and outflow rates are constant along each segment, but the rates may vary from segment to segment. The solution was determined by conformal mapping techniques applying boundary integrals. (Visocky-ISWS)
W79-05025

A NON-LINEAR OPTIMIZATION METHOD FOR THE ESTIMATION OF AQUIFER PARAMETERS,
Institute of Hydrology, Wallingford (England).
P. J. Smith, and B. S. Piper.
Journal of Hydrology, Vol. 39, No. 3/4, p 255-272, December 1978. 5 fig, 3 tab, 17 ref.

Descriptors: *Aquifers, *Transmissivity, *Storage coefficient, *Model studies, Mathematical models, Algorithms, Equations, Recharge, Natural recharge, Groundwater, Groundwater movement, Storage, Water levels, Hydrology, *Iran, *Tehran(Iran).

An algorithm for the estimation of the aquifer parameters of transmissivity and storage coefficient from historic water level and recharge data was presented. The estimated parameters can be used to develop a transient groundwater model. The estimation of these parameters is in two parts. The transmissivities are estimated initially for periods of balanced recharge using the steady-flow equations. Using these transmissivities, the storage coefficients are estimated from the transient-flow equations. No additional simplifications (such as polynomial surface representation of transmissivity) are required, thereby aiding the hydrogeological interpretation of the results. The finite-difference method of successive over-relaxation was used for the numerical solution of the steady- and transient-flow equations. For the estimation of both transmissivity and storage coefficient, a hybrid non-linear optimization method was used to minimize the difference between the observed water levels and those predicted from the flow equations. The algorithm was applied to the calibration of an aquifer model for the Tehran region of Iran. The results showed that the mean error was reduced by a factor of 3 with respect to the initial parameter estimates. (Sims-ISWS)
W79-05026

RADIAL DISPERSION TO AN ABSTRACTION WELL,
Birmingham Univ. (England). Dept. of Civil Engineering.
A. N. S. Al-Niami, and K. R. Rushton.
Journal of Hydrology, Vol. 39, No. 3/4, p 287-300, December 1978. 7 fig, 4 tab, 7 ref, 1 append.

Descriptors: *Dispersion, *Groundwater, *Pollutants, *Water wells, *Model studies, Mathematical models, Equations, Numerical analysis, Groundwater movement, Flow, Aquifers, Wells, Water pollution, Hydrology.

Analytical expressions were derived for the radial dispersion through an aquifer towards an abstraction well. Since the problem was a finite system involving two boundary conditions, analytical expressions could be obtained only for certain specific non-dimensional discharge rates. These expressions were evaluated numerically for a wide range of parameter values, and the results were presented as families of curves. A particular example showed that if the distance between the abstraction well and the source of contamination exceeds a critical distance, then contamination of the well is unlikely to occur. (Sims-ISWS)
W79-05027

FINITE-DIFFERENCE SOLUTIONS FOR ONE-DIMENSIONAL DISPERSION USING AN IMPROVED MESH DESIGN,
Birmingham Uni. (England). Dept. of Civil Engineering.
A. N. S. Al-Niami, and K. R. Rushton.
Journal of Hydrology, Vol. 39, No. 3/4, p 301-310, December 1978. 6 fig, 2 tab, 11 ref.

Descriptors: *Dispersion, *Groundwater, *Porous media, *Model studies, Mathematical models, Equations, Numerical analysis, Analytical techniques, Groundwater movement, Aquifers, Pollutants, Water pollution, Hydrology.

Two new finite-difference methods were proposed for analyzing one-dimensional dispersion problems in porous media. The essential feature of these methods is that the grid points are positioned in the regions of rapid change in concentration. Problems were analyzed with both constant and variable velocity and dispersion coefficients. (Sims-ISWS)
W79-05028

HYDROGEOLOGY OF BERMUDA--SIGNIFICANCE OF AN ACROSS-THE-ISLAND VARIATION IN PERMEABILITY,
Washington State Univ., Pullman. Dept. of Geology.
For primary bibliographic entry see Field 2L.
W79-05031

GROUND-WATER POLLUTION--A LIMITED PROBLEM,
Dunn Geoscience Corp., Latham, NY.
For primary bibliographic entry see Field 5B.
W79-05122

GROUND-WATER QUALITY STANDARDS--A NEUTRAL VIEW,
Michigan Dept. of Public Health, Lansing.
For primary bibliographic entry see Field 5B.
W79-05123

GROUND-WATER QUALITY STANDARDS--RELEVANT,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5B.
W79-05124

GROUND-WATER QUALITY STANDARDS--IRRELEVANT,
For primary bibliographic entry see Field 5B.
W79-05125

LAND APPLICATION OF WASTE--AN ACCIDENT WAITING TO HAPPEN,
Pirnie (Malcolm) Inc., Silver Spring, MD.
For primary bibliographic entry see Field 5B.
W79-05126

THE FEDERAL GROUND-WATER PROTECTION PROGRAM--A REVIEW,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5G.
W79-05127

THE FEDERAL GROUND-WATER PROTECTION PROGRAM--TODAY'S HOPE,
Environmental Protection Agency, Dallas, TX.
For primary bibliographic entry see Field 5G.
W79-05128

THE FEDERAL GROUND-WATER PROTECTION PROGRAM--TOMORROW'S UNDOING,
Wehran Engineering Corp., Middletown, NY.
For primary bibliographic entry see Field 5G.
W79-05129

STATE GROUND-WATER PROTECTION PROGRAMS--A NATIONAL SUMMARY,
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5G.
W79-05130

STATE GROUND-WATER PROTECTION PROGRAMS--INADEQUATE,
Virginia State Water Control Board, Roanoke. West Central Regional Office.
For primary bibliographic entry see Field 5G.
W79-05131

STATE GROUND-WATER PROTECTION PROGRAMS--ADEQUATE,
Minnesota Dept. of Health, Minneapolis.
For primary bibliographic entry see Field 5G.
W79-05132

AN EXAMPLE OF THE USE OF FACTOR ANALYSIS AND CLUSTER ANALYSIS IN GROUNDWATER CHEMISTRY INTERPRETATION,
Birmingham Univ. (England). Dept. of Geological Sciences.
R. P. Ashley, and J. W. Lloyd.
Journal of Hydrology, Vol. 39, No. 3/4, p 355-364, December 1978. 5 fig, 12 ref.

Descriptors: *Groundwater, *Water chemistry, *Analytical techniques, Statistics, Dissolved solids, Hardness(Water), Iron, Silica, Hydrogen ion concentration, Ions, Chemicals, Water quality, Hydrogeology, Chemistry, *Factor analysis, *Cluster analysis.

Factor analysis and cluster analysis, as applied to two widely differing sets of groundwater hydrochemical data, appear to be moderately successful as statistical tools for revealing hydrochemical and hydrogeological features, including patterns of groundwater flow. They possess advantages over the traditional graphical methods of solving similar problems, principally in their systematic nature, and they can generate inter-parameter relationships that may be overlooked in the less sophisticated traditional methods. Their disadvantages are that they are easily prone to misuse and misinterpretation due to their complexity. Further, there is a need for the user to have adequate statistical knowledge. (Sims-ISWS)
W79-05143

GROUNDWATER LEVELS IN NEBRASKA, 1977,
Geological Survey, Lincoln, NE. Water Resources Div.; and Nebraska Univ., Lincoln. Conservation and Survey Div.
M. J. Ellis, and D. T. Pederson.
Nebraska Water Survey Paper Number 45, December 1978. 96 p, 24 ref.

Descriptors: *Groundwater resources, *Water wells, *Water levels, *Water level fluctuations, *Nebraska, Observation wells, Hydrographs, Well data, Aquifer characteristics, Hydrologic data.

This report summarizes the 1977 water-level changes in Nebraska on a statewide basis and by major areas where significant changes from estimated predevelopment levels have occurred. It describes the availability of data on water levels, provides information on changes in the water-level measurement program during the year, and summarizes data on the two major causes of water-level changes--precipitation and groundwater use. Changes in water levels are illustrated by hydrographs of 66 continuous-record wells for the period of record. (Woodard-USGS)
W79-05150

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--ALASKA,
Geological Survey, Anchorage, AL. Water Resources Div.
C. Zenone, and G. S. Anderson.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.60. Geological Survey Professional Paper 813-P, 1978. 28 p, 13 fig, 4 tab, 77 ref.

Descriptors: *Groundwater resources, *Alaska, *Groundwater availability, Aquifers, Water yield, Groundwater recharge, Surface-groundwater relationships, Hydrogeology, Water supply, Permafrost, Water pollution sources, Saline water intrusion, Coasts, Water quality, Evaluation.

Ground water is a large but virtually unexplored and undeveloped resource in Alaska. Perennially frozen ground (permafrost) influences the occurrence, movement and availability of ground water except in the southern and southeastern coastal areas of the State. The most extensive aquifers occur in alluvium of major river valleys such as the Yukon, Tanana, Kuskokwim and Susitna. Large amounts of ground water are also stored in glacial outwash aquifers in coastal basin and valley deposits at Anchorage, Kenai and Juneau. Individual wells yielding more than 1,000 gallons per minute have been developed in the Tanana River Valley, Cook Inlet lowland, and the coastal valleys at Seward and Juneau. Comparable yields should be possible in other areas that have similar geohydrologic environments. Both recharge and discharge of the large alluvial aquifers are concentrated along stream channels. It is estimated that 25 percent of the total volume of streamflow in Alaska (exclusive of coastal areas) is contributed by ground-water discharge. (Woodard-USGS)
W79-05153

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--SOUTH ATLANTIC-GULF REGION,
Geological Survey, Phoenix, AZ. Water Resources Div.; Geological Survey, Jackson, MS. Water Resources Div.; and Geological Survey, Charleston, WV. Water Resources Div.
D. J. Cederstrom, E. H. Boswell, and G. R. Tarver.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.80. Geological Survey Professional Paper 813-0, 1979. 35 p, 1979. 4 tab, 86 ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Water quality, *Regional analysis, Water demand, Water supply, Water utilization, Aquifer characteristics, Conjunctive use, Evaluation, Alabama, Florida, Georgia, North Carolina, South Carolina, Virginia, *South Atlantic-Gulf Region.

The 270,000 sq mi South Atlantic-Gulf Region has ground-water resources capable of a sustained yield of 286,000 (gal/d)/sq mi. About 10 percent of the region's supply will meet the projected ground-water requirement for the year 2020. Most of the region's ground water will be developed from the extensive sedimentary Coastal Plain aquifers. The most extensive and most productive aquifers are in Tertiary limestone, Cretaceous sand and gravel, and Miocene sand. Large supplies of ground water can be developed in some places in the Cumberland Plateau and Valley and Ridge Provinces. In the Piedmont and Blue Ridge Provinces ground water is available only in moderate quantities. Ground water of acceptable chemical and physical quality is available in more than 90 percent of the region and freshwater extends to depths of slightly more than 3,000 feet in some areas. Ground-water problems are not severe although large water-level declines have occurred in some heavily-pumped areas and there are some instances of contaminated aquifers. (Woodard-USGS)
W79-05154

GEOHYDROLOGIC DATA FROM TWENTY-FOUR TEST HOLES DRILLED IN THE PICEANCE BASIN, RIO BLANCO COUNTY, COLORADO, 1975-76,
Geological Survey, Lakewood, CO. Water Resources Div.
F. A. Welder, and G. J. Saulnier, Jr.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225 Paper copy $20.75, microfiche $3.50. Geological Survey open-file report 78-734, September 1978. 132 p, 73 fig, 31 tab, 21 ref.

Descriptors: *Hydrogeology, *Hydrologic data, *Test wells, *Water yield, *Water quality, Aquifer characteristics, Oil shales, Geologic formations, Logging(Recording), Water analysis, Chemical analysis, Temperature, Potentiometric level, Saline water, Colorado, *Piceance basin, Rio Blanco County.

Twenty-four test holes were drilled in the Piceance basin, northwestern Colorado, to obtain geohydrologic data from the Uinta and Green River Formations of Eocene age. Depths of test holes ranged from 640 to 2,800 feet. The maximum quantity of water discharged during the air drilling of individual test holes ranged from 14 to 880 gallons per minute. The specific conductance of water discharged during drilling ranged from 100 to 50,000 micromhos per centimeter at 25 degrees Celsius. Aquifer tests made during drilling indicate transmissivity at four sites ranged from 100 to 1,600 feet squared per day and the storage coefficient at two sites ranged from 0.0004 to 0.00016. Depths to the static water level ranged from 30 to 695 feet. Water levels were measured in each test well, and potentiometric maps constructed from these measurements are comparable in configuration and altitude to those previously drawn from composite-head data. Water samples taken during drilling indicate that, except for water from the Uinta Formation, the water in Piceance basin is generally not suited for domestic water supply due to the presence of excessive amounts of certain trace constituents, notably fluoride. The average concentration of dissolved solids, based on data from the test holes, was 909 milligrams per liter (mg/L) for the Uinta Formation, 828 mg/L for the upper part of the Parachute Creek Member of the Green River Formation, and 3,460 mg/L for the lower part of the Parachute Creek Member. (Woodard-USGS)
W79-05164

2G. Water In Soils

THE DEVELOPMENT OF OVERLAND FLOW IN A TROPICAL RAINFOREST CATCHMENT,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geology.
For primary bibliographic entry see Field 2A.
W79-05030

MODELING THE SUBSIDENCE OF EVERGLADES ORGANIC SOIL,
Agricultural Research and Education Center, Belle Glade, FL.
S. F. Shih, J. W. Mishoe, J. W. Jones, and D. L. Myhre.
Transactions of the American Society of Agricultural Engineers, Vol. 21, No. 6, p 1151-1156, November-December 1978. 3 fig, 3 tab, 12 ref.

Descriptors: *Subsidence, *Land subsidence, *Crops, *Florida, *Model studies, Mathematical models, Organic soils, Farm management, Water table, Sugarcane, Vegetable crops, Pastures, Soils, Carbon, Soil water, Crop production, Soil science, Agriculture, Everglades organic soils.

A model related to the subsidence of histosols was introduced. The model was expanded by a power series approximation, and the coefficients of the series were obtained by using the multiple regression analysis technique. The results of the model when related to the water table with three different crop types showed that if the water tables were controlled at similar depths, the subsidence rate in sugarcane fields is about 30% less than in fields of pasture and truck crops. The model can be applied for crop period adjustment, annual subsidence rate prediction, and crop selection. (Sims-ISWS)
W79-05037

DRAINAGE IN A NATURAL LAYERED PROFILE BY FINITE ELEMENT ANALYSIS,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
M. J. Khanjani, and G. L. Bloomsburg.
Paper No. 78-2036, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 18 p. 8 fig, 1 tab, 5 ref. ASAE, St. Joseph Michigan.

Descriptors: *Drainage, Finite element analysis, Computer programs, Subsurface drains, Water table, Porosity, Hydraulic conductivity, Soil properties, *Soil profiles, Pore pressure.

An agricultural soil profile consisting of four different soil types is modeled by means of a finite element computer program. The results are in the form of a curve for water table height at midpoint between drains versus dimensionless function of time. Composite values for soil properties (apparent, conductivity, displacement head, and drainage porosity) are calculated, and the result from running a one layer composite profile are compared to results from an actual profile. The effect of drain distance above the impermeable layer is also investigated. The Dupuit-Forchheimer assumptions are not used in this analysis and unsaturated flow above the water table is considered. (Skogerboe-Colorado State)
W79-05051

SUBSURFACE DRAINAGE OF AN ALLUVIAL CLAY SOIL FOR SOYBEANS,
Science and Education Administration, Baton Rouge, LA.
For primary bibliographic entry see Field 4B.
W79-05053

INFLUENCE OF SOIL AIR AND DRAINAGE ON INFILTRATION,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
A. R. Jarrett, J. R. Hoover, and C. L. Davis.
Paper No 78-2039, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 8 p 7 fig, 22 ref ASAE, St. Joseph, Michigan.

Descriptors: *Infiltration, Infiltration rates, Drainage, Subsurface drainage, Rainfall, Runoff, Subsurface drains, Surface runoff, Laboratory tests.

The effect of soil air entrapment and subsurface drainage in a sand were evaluated. During rainfall, the entrapped soil air pressure stopped the infiltration process converting all precipitation to runoff except when the entrapped air was permitted to vent via the subsurface drain, at which time infiltration and subsurface drainage started and runoff ceased. (Skogerboe-Colorado State)
W79-05054

A SIMPLE FINITE ELEMENT METHOD OF INFILTRATION,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
R. Pall, A. R. Jarrett, and C. T. Morrow.
Paper No. 78-2068, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 10 p, 14 fig, 12 ref. ASAE, St. Joseph, Michigan.

Descriptors: Infiltration, *Infiltration rates, *Soil water movement, Numerical analysis, Finite element analysis, Darcy's law, Diffusivity, Computer models.

A numerical solution of one dimensional infiltration was developed from basic principles of flow and energy conservation using finite element technique. An exponential relationship between hydraulic diffusivity and volumetric moisture content was used for diffusivity calculations. Solutions obtained for horizontal moisture distribution gave an excellent agreement with exact solution of Scott et al. (1962) and numerical solutions of Philip (1955) and Hanks and Bowers (1962). (Skogerboe-Colorado State)
W79-05064

PREDICTING DISPERSION COEFFICIENTS IN SOILS,
Florida Univ., Gainesville.
A. G. Smajstrla, D. L. Reddell, and P. L. Barnes.
Paper No. 78-2074, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 16 p. 16 fig, 18 ref, ASAE, St. Joseph, Michigan.

Descriptors: *Dispersion, Soil physics, Numerical analysis, *Soil water movement, Capillary water, Diffusion, Simulation analysis, Model studies, Computer models.

A numerical model was developed to predict the magnitudes of dispersion coefficients as functions of soil physical and hydrologic properties and solution velocities. A capillary bundle model was used, and the bundle hydraulic properties were determined from the hydraulic conductivity function. Interaction between bundles was described as a diffusion-controlled process. The model generated breakthrough curves from simulated steady flow displacement of one soil solution with a second one. From the breakthrough curves, dispersion coefficients were calculated. The breakthrough curves and dispersion coefficients were compared with those measured in the laboratory with good agreement for unsaturated flow conditions and for saturated flow at low velocities. Agreement during saturated flow at large velocities was only obtained when a matching factor was used to describe mixing between capillary bundles. (Skogerboe-Colorado State)
W79-05067

MODELING NITROGEN MOVEMENT IN AGRICULTURAL WATERSHEDS,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
K. L. Campbell, and G. Sinai.
Paper No. 78-2071, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 15 p, 1 fig, 22 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Nitrogen, Water quality, Model studies, Simulation analysis, Pollutants, Pollution abatement, *Agricultural watersheds, Hydrology, Nutrient removal.

Techniques were developed to simulate nitrogen movement through agricultural watersheds. The USDAHL-74 (USDA-ARS Tech. Bul. No. 1518) model of watershed hydrology was used to provide the hydrologic information required to model nitrogen movement. The ACTMO (agricultural chemical transport model, USDA, ARS-H-3) nitrate model was used as a framework for the nitrogen model. Important components to be added to the ACTMO model are discussed. (Skogerboe-Colorado State)
W79-05069

VARIABILITY OF SOIL WATER RETENTION CURVES AND PREDICTED HYDRAULIC CONDUCTIVITIES ON A SMALL PLOT,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
D. R. Cameron.
Soil Science, Vol. 126, No. 6, p 364-371, December 1978. 3 fig, 4 tab, 19 ref.

Descriptors: *Hydraulic conductivity, *Soil water, *Retention, Moisture tension, Curves, Cores, Soil physical properties, Bulk density, Depth, Drying, Soil texture, Soil water movement, Clay loam soils.

Soil water retention curves were measured on cores taken from five sites at six depths in a Bainsville clay loam soil. There were differences in both the shape and magnitude of the average moisture characteristic curves from one location to another in the 225 sq m plot. Coefficients of variation ranged from 4.2 to 13% in the surface layers and from 2.4 to 6.5% in the deeper layers. There were no consistent trends in variability with respect to tensions from 0 to -500 cm H20. Predicted and measured hydraulic conductivity functions were variable, often showing a 100-fold difference at a given water content. The measured K functions were steeper than those predicted, and the match between them was considered reasonable only at the lower water contents. (Visocky-ISWS)
W79-05136

DRAINAGE RATES AND WATER-TABLE DEPTHS,
Macdonald Coll., Ste. Anne de Bellevue (Quebec). Dept. of Agricultural Engineering.
S-T. Chieng, R. S. Broughton, and N. Foroud.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR4, Proceedings Paper 14260, p 143-433, December 1978. 8 fig, 8 tab, 8 ref, 2 append.

Descriptors: *Drainage, *Drainage patterns, *Water table, *Depth, Evapotranspiration, Porosity, Precipitation(Atmospheric), Water balance, Soil moisture, Drains, Unsteady flow, Frequency analysis, Statistical methods, Statistical models, Drainage rate.

Precipitation and evapotranspiration data for 27 years from three stations in the Ottawa and St. Lawrence Lowlands were used together with a hydrologic model of the drainage process to obtain the duration of particular water table heights to be expected. An IBM 370/158 computer was used to make day-by-day calculations of the expected water table heights for a range of conditions including drainage coefficients from 3 mm/day to 15 mm/day; drain depths of 1 m, 1.4 m, and 1.8 m; drainable porosities from 0.03 to 0.11; and available soil moisture in the root zone from 60 mm to 151 mm. A statistical frequency analysis of the output was made. The results from these computations were prepared in tabular and graphical form to show the effect of drainage rate on water table height. By using a criterion for the number of days the water table may be at or less than a particular depth, a design drainage rate can be selected. (Visocky-ISWS)
W79-05137

ERRORS IN GAMMA-RAY MEASUREMENTS OF WATER CONTENT AND BULK DENSITY IN NONUNIFORM SOILS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
D. L. Nofziger.
Soil Science Society of America Journal, Vol. 42, No. 6, p 845-850, November-December 1978. 7 fig, 1 tab, 6 ref.

Descriptors: *Moisture content, *Bulk density, *Soil physical properties, *Gamma rays, Nuclear moisture meters, Measurement, Infiltration, Expansive clays, Freezing, Heterogeneity, Stratification, Stratified soil, Dual gamma-ray attenuation.

Recent experimental study of freezing soils has shown that gamma-ray measurements of water content and bulk density are in error when the water content and bulk density are not uniform throughout the gamma-ray beam. Errors in gamma-ray water content and bulk density were determined for soil water systems with linear and step-function changes in water content and bulk density and for measurements of water absorption by a non-swelling porous medium. Both single-energy and dual-energy gamma-ray systems were analyzed. Large errors in water content and bulk density determined by dual-energy gamma-ray measurements can occur for highly stratified soils. The calculated values may fall outside the range of values within a gamma-ray beam. Relatively small errors occur if bulk density and water content change linearly in the collimated beam. Both single- and dual-energy systems accurately measure the average water content in the collimated beam if the bulk density of the soil is constant. However, the average water content in the beam may not represent the water content at the middle of the collimated beam and the middle of the preset time period. Errors due to nonuniform soils can be evaluated using the equations and graphs presented. (Visocky-ISWS)
W79-05251

OBTAINING VARIATIONS OF FIELD INFILTRATION CAPACITY FROM SIMULATED RAINSTORM EXPERIMENTS (DETERMINATION DES VARIATIONS DE LA CAPACITE D'ABSORPTION D'UN SOL EN PLACE SOUS AVERSES SIMULEES),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France). Hydrology Section.
A. Lafforgue.
Hydrological Sciences Bulletin, Vol. 23, No. 3, p 355-372, September 1978. 9 fig, 1 tab, 2 ref.

Descriptors: *Runoff, *Infiltration, *Soil water, *Model studies, Simulated rainfall, Laboratory tests, Hydraulic models, Soil moisture, Storage, Analytical techniques, Analysis, Mathematical models, Infiltration rates, Retention, Storage capacity, Rainfall-runoff relationships, Soil water movement, Moisture content, Foreign research, *France.

By sprinkling an experimental plot with different intensities of simulated rainfall starting with different initial conditions of soil moisture, the variations of infiltration capacity, and consequently the response of the soil surface to runoff, were evaluated. The following values were determined successively from experimental data: the mean depth of surface storage, the mean depth of detention, and the parameters of a chosen infiltration formula. (Humphreys-ISWS)
W79-05257

THE APPLICABILITY OF DUAL GAMMA SCANNING TO FREEZING SOILS AND THE PROBLEM OF STRATIFICATION,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
For primary bibliographic entry see Field 2C.
W79-05260

LATERALLY CONFINED FLOW FROM A POINT SOURCE AT THE SURFACE OF AN INHOMOGENEOUS SOIL COLUMN,
Science and Education Administration, Mandan, MD. Northern Great Plains Research Center.
S. D. Merrill, P. A. C. Raats, and C. Dirksen.
Soil Science Society of America Journal, Vol. 42, No. 6, p 851-857, November-December 1978. 8 fig, 18 ref.

Descriptors: *Confined water, *Heterogeneity, *Soils, *Model studies, *Infiltration, Hydraulic conductivity, Irrigation, Mathematical models, Equations, Theoretical analysis, Pressure head, Measurement, Soil water movement, Flow, Point source, Drip irrigation, Trickle irrigation, Lateral flow.

Solution of a linearized flow equation for steady, axisymmetric, laterally confined infiltration from a point source located at the soil surface was compared with pressure head patterns measured in an undisturbed column of sandy loam. The geometry approximates an array of trickle irrigation emitters. The hydraulic conductivity could be represented as an exponential function of both the pressure head and the depth in the column. This implies that steady, multidimensional flow in the column is described by a linear flow equation. Measured and predicted distributions of pressure head agreed most closely at an application rate of 0.5 cm/day. Increase in the size of a saturated zone about the point source at application rates higher than 0.5 cm/day caused isolines of pressure head to be distorted from the predicted shape. Flow patterns for homogeneous and heterogeneous soil were compared. Trickle irrigation systems usually are operated intermittently. Measured distributions of pressure heads under intermittent application were compared with steady infiltration patterns. A steady-flow solution will give an approximate prediction of intermittent pressure head patterns for continuously repeated application cycles over part of the flow region and during part of the time. (Visocky-ISWS)
W79-05261

APPLICATION OF STRAW IN AGRICULTURE IN THE ARID STEPPE ZONE OF THE NORTHERN KAZAKH SSR (IN RUSSIAN),
Tselinograd Agricultural Inst. (USSR).
N. I. Kanivets, and V. A. Fomin.
Izv Akad Nauk Sssr Ser Biol (4) p 534-540. 1977. (English summary).

Descriptors: *Mulching, *Crop response, USSR, Wheat.

The effect of mulching with straw on microbiological properties, humidity and nutritional conditions of the soil and on the yield of summer wheat on dark-chestnut soils of the Tselinnograd region (USSR) was studied. Mulching enhanced the soil microbiological activity, improved water and thermal conditions and promoted phosphate availability, resulting in increased yields.-Copyright 1978, Biological Abstracts, Inc.
W79-05343

2H. Lakes

MATHEMATICAL MODELING OF SURFACE WATER IMPOUNDMENTS, VOLUME: I, AND II,
Resource Management Associates, Lafayette, CA.
G. T. Orlob.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 204, Price codes: A16 in paper copy, A01 in microfiche. Report, 1977. 2 volumes, 354 p, 13 fig, 1 tab, 440 ref, 3 append. OWRT T-0006(6706)(1).

Descriptors: *Impoundments, *Lakes, *Reservoirs, *Mathematical models, Simulation, Optimization, Stratified flow, Hydrodynamics, Stochastic processes, Linear programming, Dynamic programming, Lake Erie, Lake Ontario, Lake Washington, Fontana Reservoir.

A review of the state-of-the-art of mathematical modeling of surface water impoundments was conducted. Models reviewed included one-dimensional models for simulation of temperature and water quality in stratified reservoirs, two-dimensional circulation and water quality in shallow lakes, two-dimensional stratified flow, circulation in multilayer large lakes, and eutrophication and ecological responses in lake systems. Model for simulation/optimization of single reservoir and multiple reservoir systems were also reviewed, including LP, DP, explicit and implicit stochastic methods, and simulation techniques. Recommendations are made for the formation of a 'national register' of software for water resource planning and management, with functions of facilitating technology transfer, standardizing documentation procedures, and disseminating information on mathematical models to potential users.
W79-05011

AN EVENT-BASED STOCHASTIC MODEL OF PHOSPHORUS LOADING INTO A LAKE,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering and Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 5B.
W79-05021

SIZING OF RESERVOIRS FOR PERIODIC-STOCHASTIC INPUT AND PERIODIC OUTPUT,
Engineering Consultants, Inc., Denver, CO.
K. N. Mutreja, and V. Yevjevich.
Journal of Hydrology, Vol. 39, No. 3/4, p 323-338, December 1978. 7 fig, 3 tab, 13 ref. NSF ENG74-17396.

Descriptors: *Reservoirs, *Storage capacity, *Model studies, Mathematical models, Stochastic processes, Analytical techniques, Storage, Flow, Rivers, Streamflow, Regulated flow, Inflow, Discharge(Water), Water supply, Hydrology.

A method was presented for designing the capacities of large storage reservoirs with relatively high levels of regulation by using the mass curve and the maximum deficit rather than the range of the short-interval flows such as the daily flows. These reservoir inputs were composed of periodic parameters and stochastic components. The output was a deterministic process, either constant or periodic. Both the analytical and the data generation methods were used for computing the required storage capacities and for regulating the periodic-stochastic inputs to deterministic outputs. The mean required storage capacity was designated as the total storage. The total storage was defined as the expected maximum deficit of the net input to a reservoir. It was divided into the difference storage and the stochastic storage, with the total storage equal to the difference storage plus the stochastic storage. Difference storage is needed because of the periodic means of input and output. It is approximately constant for large samples, and can be estimated for different sample sizes by generating the relatively short series of daily flows. Stochastic storage is defined as the expected maximum deficit of the stochastic net input. It was computed analytically by using a coefficient estimated from the generated short series of daily flows. The method presented for the determination of the total storage by its decomposition into the difference storage and the stochastic storage was applied to a case study in determining the storage capacity of a reservoir with the economic life of 100 years, to be constructed as a site for which 40 years of daily flows are available (the Oconto River, near Gillet, Wisconsin). (Sims-ISWS)
W79-05029

MATHEMATICAL MODELING OF SEDIMENT DEPOSITION IN RESERVOIRS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-05142

EXPECTED ASYMPTOTIC MAXIMUM DEFICIT FOR PERIODIC-STOCHASTIC RESERVOIR INFLOWS IN CASE OF PARTIAL FLOW REGULATION,
Engineering Consultants, Inc., Denver, CO.
K. N. Mutreja, and V. Yevjevich.
Journal of Hydrology, Vol. 39, No. 3/4, p 311-321, December 1978. 3 fig, 3 tab, 5 ref. NSF ENG74-17396.

Descriptors: *Reservoirs, *Storage capacity, *Regulated flow, *Model studies, Mathematical models, Inflow, Discharge(Water), Water supply, Flow,

Storage, Stochastic processes, Analytical techniques, Hydrology.

So far, no exact expression analytically derived is available for the expected asymptotic maximum reservoir deficit of periodic-stochastic net inflows. The reasons are in the complexities involved. A method for obtaining this maximum deficit for the case of full flow regulation has been presented in another paper. This paper treated the case of partial flow regulation. The storage required by the periodicity in the mean was added to the expected asymptotic maximum deficit of the stochastic component of net input to reservoir. The storage required by the periodicity in the mean was approximated by a constant. The same approach is also valid for the partial flow regulation. (See also W78-02791) (Sims-ISWS)
W79-05145

CHARACTERISTICS OF PENNSYLVANIA RECREATIONAL LAKES,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. L. Barker.
Pennsylvania Department of Environmental Resources Bulletin No 14, April 1978. 226 p, 24 ref, append.

Descriptors: *Limnology, *Pennsylvania, *Lakes, *Impoundments, *Water quality, Eutrophication, Nutrients, Pesticides, Plankton, Dissolved solids, Chemical properties, Biological properties, Freshwater, Thermocline, Epilimnion, Hypolimnion, Mixing, Recreational lakes.

Limnological surveys of 53 multiple-use impoundments throughout Pennsylvania were conducted during July and August from 1971 through 1975. The lakes ranged in size from 4 acres to 14,500 acres and represent a cross section of the chemical and trophic types found in Pennsylvania. Temperature and oxygen profiles indicate that nearly all impoundments having depths greater than 19.7 feet become stratified thermally and chemically. The deeper lakes with longer residence time generally develop a higher degree of thermal stability. Dissolved oxygen supersaturation in the epilimnion and depletion in the metalimnion and hypolimnion is common in many lakes during the summer stagnation. The stratified impoundments 'turn-over' or mix during the spring and autumn and are, therefore, classified as dimictic. The dissolved solids concentrations of lakes range from about 17 to 130 milligrams per liter, in the absence of mine drainage or other pollutants. The general sources of dissolved solids, in descending order of significance, were weathered carbonate rocks, unconsolidated water-sorted sediment, igneous and metamorphic rocks, noncarbonate sedimentary rocks, and glacial drift. Each lake is described with a map, a list of physical and morphological features, a brief discussion of water quality and biological characteristics, temperature and dissolved oxygen profiles, and tabulated basic data. The basic data include chemical analyses for the common constituents, trace metals, and pesticides. Lists of the major plankters and hydrophytes are included as well as an estimate of their relative abundance. (Woodard-USGS)
W79-05168

MITIGATING ADVERSE ENVIRONMENTAL EFFECTS OF HIGHWAY CONSTRUCTION.
For primary bibliographic entry see Field 6G.
W79-05235

INTERNAL WAVES IN A CIRCULAR CHANNEL,
Michigan Univ., Ann Arbor. Dept. of Applied Mechanics and Engineering Science.
W. H. Yang, and C-S. Yih.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-034 331, Price codes: A02 in paper copy, A01 in microfiche. Journal of Fluid Mechanics, Vol. 74, Pt. 1, p 183-192, December 31, 1976. 3 fig, 8 ref.

Descriptors: *Waves(Water), *Theoretical analysis, *Frequency, Analysis, Stratification, Lakes, Channels, Equations, Mathematics, Flow. *Wave modes.

The frequencies of the first four sloshing internal wave modes in two superposed fluid layers contained in a circular channel were calculated for two positions of the free surface and for various ratios of the depths of the two layers. Flow patterns were given for the first four sloshing modes for the case in which the fluids occupy a semicircular space and the depth of the upper layer is 1/4 of the radius. The results obtained provide a guide for estimating the frequencies of sloshing internal wave modes in long lakes. (Adams-ISWS).
W79-05250

COMPARISON THEOREMS FOR GRAVITY WAVES IN BASINS OF VARIABLE DEPTH,
Michigan Univ., Ann Arbor.
C-S. Yih.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-034 330, Price codes: A02 in paper copy, A01 in microfiche. Quarterly of Applied Mathematics, Vol. 33, p 387-394, January 1976. 1 fig, 3 ref.

Descriptors: *Waves(Water), *Theoretical analysis, *Frequency, Analysis mathematics, Stratification, Lakes, Equations, Basins, Model studies. *Comparisons, Two-layer models.

Surface waves of a homogeneous liquid and internal waves of a stratified liquid in basins of variable depth were considered. Inequalities involving the frequencies of oscillation are obtained when a container with one size or geometry is compared with another of a different size or geometry, when waves with one wavelength are compared with waves of another wavelength, or when one stratification is compared with another. Since exact solutions for gravity waves in basins of variable depth are so rare, the comparison theorems presented herein will be useful. (Adams-ISWS).
W79-05253

A TIME-DEPENDENT MODEL OF A COASTAL BOUNDARY LAYER WITH FRICTION,
Northwestern Univ., Evanston, IL. Dept. of Geological Sciences; and Northwestern Univ., Evanston, IL. Dept. of Engineering Sciences and Applied Mathematics.
G. E. Birchfield, and A. T. Lunde.
Journal of Geophysical Research, Vol. 83, No. C12, p 6155-6162, December 20, 1978. 4 fig, 2 tab, 7 ref, append.

Descriptors: *Boundary layers, *Lakes, *Fluid friction, *Model studies, *Great Lakes, Mathematical models, Winds, Currents(Water), Water circulation, Waves(Water), Coasts, Mathematics, Equations, Limnology, Coastal boundary layers.

The time-dependent development of a coastal frictional boundary layer forced by a wind stress impulse was investigated. Although because of mathematical nonuniforities in space and time a solution was found which was restricted to an inner region dominated by bottom friction, some details of the coastal response were found. In the context of a coastal response pf a lake of the size of Lake Ontario, it was found that maximum surface displacements of several centimeters occur in the left upwind and right downwind quadrants of the basin. In the adjustment to steady-state, the displacements propagate counterclockwise around the coastal region. The coastal jets with maxima in the same quadrants do not move significant distances in the approach to steady-state. Several aspects of the model appeared in a forced response observed on the south shore of Lake Ontario. (Sims-ISWS)
W79-05263

A MATHEMATICAL MODEL FOR PREDICTING RIVER TEMPERATURES--APPLICATION TO THE GREEN RIVER BELOW FLAMING GORGE DAM,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. J. Sartoris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 989, Price codes:A03 in paper copy, A01 in microfiche. REC-ERC-76-7. Engineering and Research Center, Bureau of Reclamation, Denver, CO., April 1976. 28 p, 6 fig, 6 tab, 10 ref, 4 append.

Descriptors: *Rivers, *Mathematical models, *Water temperature, *Selective level releases, Fish, Conservation, Computer programs, Multilevel lakes, Temperature control, Simulation analysis, Computer models, Fisheries, Dams, Evaluation, Empirical equations, Green River(Utah-Col.), Flaming Gorge Reservoir(Utah-Wyoming), Systems analysis.

The purpose of this study was to evaluate the effect of selective withdrawal modifications at Flaming Gorge Dam on temperatures in the Green River downstream. A computerized mathematical temperature model, incorporating the conservation of heat equation and an equilibrium temperature approach to heat exchange, was developed for this purpose. The model was calibrated, using 1974 average daily meteorological and hydrological data, to observed temperatures at three river stations, covering a total distance below the dam of 70.0 kilometres (43.5 river miles). The average monthly error between predicted and observed mean daily river temperatures at these stations ranged from 0 to 1.2C (0 to -2.2F). The calibrated model was used to simulate river temperatures for the case of only two penstock intake structures modified for selective withdrawal and for all three intakes modified. Simulation results indicate that, while the two-intake modification strategy would result in river temperatures significantly nearer the optimum fishery range than those recorded in 1974, operation with all three intakes modified would generally result in optimum fishery temperatures from May through September. The computer model developed in this study could be adapted to a variety of data and stream conditions. (Bell-Graf-Cornell)
W79-05283

2I. Water In Plants

PLANT NUTRIENT LOSSES FROM FOLIAR-FERTILIZED SOYBEANS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W79-05056

INFLUENCE OF ROW SPACING OF GRAIN SORGHUM ON GROUND COVER, RUNOFF, AND EROSION,
Science and Education Administration, Temple, TX. Grassland, Soil and Water Research Lab.
For primary bibliographic entry see Field 3F.
W79-05258

REACTION OF SOYBEANS TO OVERFLOODING OF SOIL, (IN RUSSIAN),
Far East State Univ., Vladivostok (USSR).
V. E. Kosmakova, A. F. Skripchenko, L. T. Prozumenshchikova, N. S. Nikonova, and E. A. Belyavskaya.
S-Kh Biol Vol. 10, No. 3, p 359-363. 1975. (English summary).

Descriptors: *Flooding, *Crop response, *Soybeans.

Metabolism in soybean plants is greatly disturbed after 5-7 days of flooding of soil: respiration becomes stronger in leaves, content of nucleic acids and protein decreases, and composition of organic acids changes. If the flooding is prolonged the intensity of respiration in roots falls to zero and the nucleic acid content decreases. The photosynthesis of turgescent leaves remains the same but the release of assimilates from them slows down. The intake of assimilates by roots is inhibited. Under

the conditions of flooding of soil doubling of functions occurs: green leaves take the function of yellow and fallen leaves. Under such conditions the functioning of regulatory systems in soybean plants results in root regeneration. --Copyright 1976, Biological Abstracts, Inc.
W79-05284

EFFECT OF SOIL HUMIDITY ON NITRATE REDUCTASE ACTIVITY IN BARLEY SHOOT LEAVES (IN RUSSIAN),
Leningrad State Pedagogical Inst. (USSR).
V. V. Anikiev, and M. K. Kuramagomedov.
Fiziol Rast (Mosc), Vol. 11, No. 2, p. 354-358. 1975. (English summary).

Descriptors: *Barley, Leaves, *Nitrate, Organogenesis, Reductase, *Crop response, *Moisture stress, Soil moisture.

The activity of nitrate reductase was studied in the leaves of the main and lateral shoots of barley, cultivar 'Viner', under the conditions of optimal soil humidity and insufficient water supply during the 6th stage of organogenesis (microsporogenesis). The main and lateral shoots were different physiologically and varied in the activity of nitrate reductase. The younger the shoot, the higher the activity of the enzyme. This activity decreased in the leaves of each shoot in the course of organogenesis. The content of nitrate N in the leaves of different shoots changed in a similar way. The content of protein and sugars was lower in the lateral shoots. The activity of nitrate reductase decreased during drought, especially in the lateral shoots, accompanied by the accumulation of nitrate N and a decrease in the content of protein.--Copyright 1976, Biological Abstracts, Inc.
W79-05314

EFFECT OF TRANSPIRATION RATE ON THE UPTAKE OF MINERAL ELEMENTS BY ALFALFA PLANTS (IN BULGARIAN),
Institute Plant Physiology, Sofia (Bulgaria).
T. Kudrev, and V. Radeva.
Fiziol Rast (Sofia), Vol 1, No 3, p 54-63. 1975. English summary.

Descriptors: *Alfalfa, *Nutrients, Plants, *Transpiration, Winds, Temperature.

The experimental pattern was control, plants grown under normal greenhouse conditions; blowing on the plants with a wind velocity of 2m/s; blowing on the plants with a wind velocity of 4 m/s (the air temperature was the same for the control and 2 treatments); blowing on the plants with a warm wind having velocity of 4 m/s and a 5.5C higher temperature than the control. Transpiration, nutrient uptake and the dry matter produced for a 10 day-period at the anthesis phase, when the plants were wind blown, were followed. A definite relationship exists between the transpiration rate and the mineral uptake; the rise in transpiration led to a rise in nutrient uptake. After the transpiration optimum passed, the rise in transpiration rate had a negative effect on mineral substances uptake. Under the experimental conditions, optimal transpiration intensity was observed for the control, where on 1 dm3 transpired water, the plants grown on 1 and 3 doses of nutrient solution had the following uptake: 61.9 and 89.7 mg N, 6.9 and 11.4 mg P, 49.3 and 92.7 mg K, 32.0 and 45.2 mg Ca, 9.0 and 14.4 mg Mg, or a total of 158.5 and 253.5 mg of mineral elements, respectively. The reduction of transpiration by 13.7-17.8% caused reduced mineral uptake. The plants grown on 1 or 3 doses of nutrient solution took up 22.4 and 44.2 mg N, 3.7 and 5.8 mg P, 27.4 and 48.6 mg K, 14.5 and 20.4 mg Ca, 4.9 and 7.0 mg Mg or a total of 72.9 and 126.0 mg of mineral elements per 1 dm3 of transpired water.--Copyright 1976, Biological Abstracts, Inc.
W79-05321

GROWTH RHYTHMS OF WHEAT VEGETATIVE ORGANS AND THE EFFECT OF DROUGHT ON THEM (IN RUSSIAN),
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Inst. Botaniki.
B. I. Shcherbakov.
Fiziol Rast (Mosc) Vol. 24, No. 1, p 113-117. 1977. (English summary).

Descriptors: *Drought tolerance, *Wheat, Plant growth, Growth stages.

The effect of soil drought on growth rhythms of summer wheat vegetative organs was evaluated by changes in their dimensions and mass. In favorable conditions of water supply, growth rhythm of wheat leaves follows parabolic curve. During drought, in the course of the I-IV stages of organogenesis, growth rhythm of the leaves follows diparabolic curve. Growth rhythm of wheat internodes is of exponential character and does not change in conditions of drought. During drought, the rate of organ growth is slower, the duration of growth is shorter and the number of members constituting their metameric series per 1 plastochrone decreases. Changes in growth rhythms of wheat are of the functional-adaptive nature.-Copyright 1978, Biological Abstracts, Inc.
W79-05327

WATER DEMAND AND YIELD OF GRAIN CROPS IN CULTIVATION SYSTEMS OF DIFFERENT INTENSITY, (IN RUSSIAN),
Moskovskaya Selskokhozyaistvennaya Akademiya (USSR). Div. of Farming Experiment Methods.
B. A. Dospekhov, A. Ya. Rassadin, and A. E. Alekseeva.
Izv Timiryazev S-Kh Akad (5), p 39-46. 1977. English summary.

Descriptors: Barley, Cultivation, Fertilizers, Oats, Potatoes, Rainfall, Vetch, Winter wheat, *Crop response.

The effect of systems of management, cultivation and subsoiling on soddy-podzolic medium loams on water consumption and yield of crops (winter wheat, potatoes, barley, vetch, oats) under conditions of complex experiment conducted on the Timiryazev Academy Experimental farm Mikhailovskoye in Podolsky district of Moscow region (USSR) are considered. In years with ample rainfall deeper cultivation up to 30-40 cm did not produce a significant effect on the accumulation of moisture in the growing season, rototilling with an organic and mineral fertilizer background reduced water discharge by evaporation by 23%; water consumption coefficient of grain crops was reduced by 16-19%, while the average application of fertilizers on all cultivations reduced it by 21-28%. Increasing the top soil by cultivation from 20-40 cm raised the availability of soil moisture from the root zone for plants by 11%.--Copyright 1978, Biological Abstracts, Inc.
W79-05336

THE WATER STATE AND DROUGHT RESISTANCE OF GRAPES IN THE KOPET-DAG PIEDMONT SUBZONE (IN RUSSIAN),
E. E. Nagieva.
Izv Akad Nauk Turkm Ssr Ser Biol Nauk 3 p 53-59. 1977.

Descriptors: Water loss, Saturation, Turgor, USSR, *Grapes, *Drought resistance.

A study of the daytime water state, relative turgor resistance and water retaining capacity of leaves in 6 grape cultivars introduced into the hot, dry climate of southern Turkmen SSR (USSR) indicated considerable variations in the first 2 categories during the delay in the summer, in direct correlation with the pressure of meteorological factors. Restoration of turgor after water saturation was proportional to the extent of water loss during wilting, and was not related to the degree of variation of their water state or their relative turgor resistance during the course of the day.-Copyright 1978, Biological Abstracts, Inc.
W79-05342

EFFECTS OF IRRIGATION METHODS ON WATER EXCHANGE AND CROP CAPACITY IN APPLE TREE (IN RUSSIAN),
Akademiya Nauk Moldavskoi SSR, Kishinev. Inst. of Plant Physiology and Biochemistry.
M. D. Kushinrenko, R. A. Batyr, and A. A. Shtefyrtse.
Fiziol Biokhim Kul'T Rast 7(3): 241-245. Illus. 1975. (English summary).

Descriptors: *Irrigation effects, *Crop response, Apples, Spray irrigation.

Spray irrigation, especially at night, produced a favorable effect on the water regime and productivity of the cultivars 'Jonathan' and 'Parmen zimny zolotoy' ('Winter Gold'). With irrigation the apple trees utilize water less effectively and their productivity is lower than that of plants subjected to spray irrigation. The plants, particularly those subjected to furrow irrigation, have low water-retaining capacity and need regular irrigation.--Copyright 1976, Biological Abstracts, Inc.
W79-05382

2J. Erosion and Sedimentation

WEAR OF UNSOUND PEBBLES IN RIVER HEADWATERS,
Cornell Univ., Ithaca, NY. Dept. of Geological Sciences.
J. Adams.
Science, Vol. 203, No. 4376, p 171-172, January 12, 1979. 3 fig, 2 ref.

Descriptors: *Streamflow, *Erosion, *Rocks, *Model studies, Mathematical models, On-site investigations, On-site data collections, Data processing, Weathering, Quartz, Headwaters, Streams, Rivers, Particle size, Abrasion, Geomorphology, *New Zealand, *Pebbles, Pebble size, Pebble wear, Schist, Wear.

Pebbles that are initially weathered, inhomogeneous, angular, or fractured ('unsound') become sound with transport. The Sternberg law describes well the wear of sound pebbles found in large rivers, but the law describes poorly that of unsound pebbles in river headwaters. For unsound pebbles, the Sternberg coefficient (which is assumed to be a constant) decreases appreciably downstream. An alternative to the Sternberg law was derived in which the coefficient is proportional to the reciprocal of the downstream distance traveled. The laws were compared by using data from the Clutha basin in New Zealand. (Sims-ISWS)
W79-05016

SEDIMENT CHARACTERISTICS AND TRANSPORT FROM NORTHWEST RANGELAND WATERSHEDS,
Science and Education Administration, Boise, ID. Northwest Watershed Research Center.
C. W. Johnson, and J. P. Smith.
Transactions of the American Society of Agricultural Engineers, Vol. 21, No. 6, p 1157-1163, 1168, November-December 1978. 12 fig, 9 tab, 14 ref.

Descriptors: *Sediments, *Sediment transport, *Watersheds(Basins), *Idaho, Ranges, Streams, Bed load, Particle size, Sampling, On-site investigations, Weirs, Sediment yield, Sediment load, Sediment discharge, Rainfall, Precipitation(Atmospheric), Runoff, Streamflow.

Rangeland hydrology and sedimentation studies on a main stem and three source watersheds within the Reynolds Creek Experimental Watershed showed a wide range in precipitation, runoff, sediment transport, sediment yield, and particle-size characteristics from year to year and from station to station. Results are useful to provide data in rangeland erosion and sediment models. (Sims-ISWS)
W79-05035

SOIL EROSION AND SEDIMENT MOVEMENT UNDER SUGARCANE CULTURE ON THE FLAT LANDS OF SOUTHERN LOUISIANA,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
A. P. Barnett, A. E. Dooley, and G. A. Smith.
Transactions of the American Society of Agricultural Engineers, Vol. 21, No. 6, p 1144-1150, 1156, November-December 1978. 2 fig, 7 tab, 25 ref.

Descriptors: *Soils, *Soil erosion, *Simulated rainfall, *Louisiana, On-site investigations, Crops, Sugarcane, Runoff, Erosion, Sediments, Sediment transport, Soil types, Farm management, Ditches, Sedimentation, Water quality, Soil science, Agriculture.

Commerce and Sharkey soils were found to be highly erodible. Simulated rainfall tests resulted in soil erodibility factors (K) of 0.63 and 0.44, respectively, for Commerce and Sharkey soils; metric K's were 0.81 and 0.57. A cropping factor for a conventional four-year sugarcane cropping system was found to be 0.41. Soil erodibility factors derived from field data were compared with those determined with the Wischmeier nomograph. Due to good aggregation and aggregate stability, these silt loam and silty clay soils were found to have apparent sandy loam surface textures, and to behave more like sandy loam than like silt and clay soils during the erosion process. (Sims-ISWS)
W79-05038

SEDIMENTATION MODELING OF IMPOUNDMENT TERRACES,
Science and Education Administration, Ames, IA. North Central Region.
J. M. Laflen, H. P. Johnson, and R. O. Hartwig.
Transactions of the American Society of Agricultural Engineers, Vol. 21, No. 6, p 1131-1135, November-December 1978. 5 fig, 3 tab, 8 ref.

Descriptors: *Soil erosion, *Sediments, *Terracing, *Impoundments, Sedimentation, Model studies, Mathematical models, On-site investigations, Particle size, Soils, Soil science, Agriculture, Impoundment terraces.

A simulation model for predicting sediment concentration in water discharged from impoundment terraces was described. The model was based on the assumption that sediment concentration of the discharge water equals that of the water at the bottom of the impoundment near the outlet. Stoke's law was used to compute fall velocity of sediments suspended in the impoundment. Sediment concentration at the bottom of the pondage area is based on fall velocities of sediment, initial sediment concentration, initial sediment-size distribution, and the existence of an initial homogeneous sediment-water mixture within the impoundment. Sediment concentration in discharge from a single impoundment was predicted with acceptable accuracy. Under limited field testing, the model gave valid results. (Sims-ISWS)
W79-05039

CHARACTERIZATION OF RILL AND INTERRILL ERODED SOIL,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center.
R. A. Young, and C. A. Onstad.
Transactions of the American Society of Agricultural Engineers, Vol 21, No 6, p 1126-1130, November-December 1978. 5 fig, 4 tab, 25 ref.

Descriptors: *Soil erosion, *Sediments, *Laboratory tests, Soils, Soil types, Rill erosion, Erosion, Simulated rainfall, Particle size, Aggregates, Runoff, Soil science, Eroded soil, Interrill erosion.

Three soils were subjected to simulated rainfall to induce runoff and soil loss from 1.52- by 4.52-m laboratory plots with preformed rills. Soil loss was separated into that originating in the rill and that in interrill areas. The relative amounts of rill- and interrill-eroded soil were related to soil aggregation, aggregate stability, soil organic matter content, and particle-size distribution. Soil with a high degree of aggregation and relatively water-stable aggregates was less susceptible to interrill erosion (erosion by raindrop) than was more poorly aggregated soil. However, soil loss in organic matter was much more susceptible to rill erosion (erosion from flowing water). Also, the degree of slope tended to affect the source of the eroded material with the interill areas providing an increasingly larger percentage of the total soil loss as the degree of slope increased. (Sims-ISWS)
W79-05040

EROSION SIMULATION FOR LAND USE MANAGEMENT,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
D. G. DeCoursey.
Paper No. 78-2082, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 18 p. 6 fig, 8 tab. ASAE, St. Joseph, Michigan.

Descriptors: *Soil erosion, Erosion, Simulation analysis, Runoff, Surface runoff, Sediment yield, Hydrographs, Land management, *Land use, Cotton.

In May, 1976, a paper entitled 'Philosophy of Erosion Simulation for Land Use Management' by D. G. DeCoursey and L. D. Meyer was presented at a Soil Erosion Workshop at Purdue University. The paper described schematically, a concept for combining hydrology, infiltration, moisture redistribution, crop growth, and rill-interrill erosion models to produce a dynamic simulation system that can be assembled to evaluate the environmental impact of land management alternatives. Most of the parameters are based on measurable factors or field tests. This paper describes such a simulation system and the data necessary to use it. Data from a cotton field in the Mississippi Delta were used to test and refine the system. Examples showing how the system can be used to evaluate alternative land management schemes are presented. Output from the system includes runoff, sediment, and cotton production. They were used to show how factors such as plant population fertilizer, row spacing, land slope and tillage operations can affect management alternatives. (Skogerboe-Colorado State)
W79-05055

REDUCING STREAM SEDIMENT LOADS BY IRRIGATION DIVERSIONS,
Science and Education Administration, Boise, ID. Northwest Watershed Research Center.
C. W. Johnson, and J. P. Smith.
Paper No 78-2088, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 14 p, 4 fig, 4 tab, 11 ref. ASAE, St Joseph Michigan.

Descriptors: Sediment control, *Sediment load, Sediment discharge, Soil erosion, Streamflow, Diversion, Diversion structures, *Irrigation effects, Idaho.

A streamflow, irrigation diversion, and suspended sediment study on the Reynolds Creek Experimental Watershed in southwest Idaho shows the effectiveness of an irrigation system in reducing downstream sediment loads. About 560 tonnes of sediment per year was deposited on 690 ha of pasture, hay, and grain cropland, an average deposition of 0.08 mm per year. The sediment from natural streamflow is usually beneficial to crop production in this mountain valley. (Skogerboe-Colorado State)
W79-05057

EXCAVATED SEDIMENT TRAPS -- WHAT RALPH WALDO EMERSON WAS REALLY TALKING ABOUT,
C. P. Tryon, B. L. Parsons, and M. R. Miller.
Paper No 78-2089, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 10 p, 9 ref. ASAE, St Joseph Michigan.

Descriptors: Sediment control, *Sediment load, Soil erosion, *Detention reservoirs, Erosion, Cost comparisons, Comparative costs, Missouri.

A decade of experience on large earth moving jobs in the Missouri Ozarks has shown that excavated sediment traps are incomparably superior to small detention dams in terms of cost, industry acceptance, and sediment trap efficiency. (Skogerboe-Colorado State)
W79-05058

SEDROUTE PROCEDURE FOR ESTIMATING EROSION AND SEDIMENT IMPACTS,
G. D. Kelly.
Paper No. 78-2081, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 7 p, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sediment yield, *Surface runoff, Runoff, Model studies, Sediment load, Mining, Sediment control, Idaho.

The SEDROUTE procedure predicts the amount and charge in erosion and sediment yield that will occur from a proposed project. The model uses a minimum of data and responds to changing project details. Impacts are routed downstream to show the effects of other water and sediment sources. (Skogerboe-Colorado State)
W79-05066

SEA RESEARCH PROGRAM FOR CHANNEL STABILITY AND GULLY CONTROL,
Science and Education Administration, Oxford, MS.
W. C. Little, R. F. Piest, and A. R. Robinson.
Paper No. 78-2080, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 18 p, 13 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Channel erosion, Channel improvement, Stability, Gully erosion, Stream erosion, Stabilization, Environmental effects.

There are a multitude of factors relating to problems of unstable channels and active gullies. There are limited methods of control and additional cost effective methods are required. The potential for improved technology is great. The USDA, Science and Education Administration, Federal Research Program is conducting research on stabilization of stream channels and control of gullies. Channel stability and gulley problems and solutions are reviewed and present research programs and future research approaches are described. (Skogerboe-Colorado State)
W79-05068

FLUVIAL PROCESSES AND FACIES SEQUENCES IN THE SANDY BRAIDED SOUTH SASKATCHEWAN RIVER, CANADA,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
D. J. Cant, and R. G. Walker.
Sedimentology, Vol. 25, No. 5, p 625-648, 1978. 15 fig, 30 ref.

Descriptors: *Channel morphology, *Alluvial channels, *Rivers, *Braiding, *Canada, Deposition(Sediments), Geomorphology, Meanders, Streambeds, Sand bars, Sand waves, Movement, Aggradation, Facies(Sedimentary), Stratigraphy, Shape, Discharge(Water), Channels, Shoals, On-site investigations, Flood plains, *South Saskatchewan River(Canada), Sand flats.

The South Saskatchewan River has a long-term average discharge of 275 cu m/sec, with flood peaks in the range of 1500 to 3800 cu m/sec. South of Saskatoon, the four major types of geomorphological elements recognized are channels, slipface-bounded bars, sand flats and vegetated islands, and floodplains. Major channels are 3-5 m deep, up to 200 m wide, and flow around sand flats which are 50-2000 m long, and around vegetated islands up to 1 km long. At areas of flow expansion, long,

straight-crested, cross-channel bars form. During falling stage, a small part of the crest of the cross-channel bar may become emergent and act as a nucleus for downstream and lateral growth of a new sand flat. The dominant channel bedforms are dunes, which deposit trough cross bedding. Cross-channel bars deposit large sets of planar tabular cross bedding. Sand flats that grow from a nucleus on a cross-channel bar are composed mostly of smaller planar tabular sets, with some parallel lamination, trough cross-bedding, and ripple cross-lamination. A typical facies sequence related to sand flat growth consists of in-channel trough cross-bedding, overlain by a large (1-2 m) planar tabular set (cross-channel bar), overlain in turn by a complex association mostly of small planar tabular cross-beds, trough cross-beds and ripple cross-lamination. By contrast, a second stratigraphic sequence can be proposed, related only to channel aggradation. It would consist dominantly of trough cross-beds, decreasing in scale upward, and possibly interrupted by isolated sets of planar tabular cross-bedding if a cross-channel bar formed, but failed to grow into a sand flat. During final filling of the channel, ripple cross-lamination and thin clay layers may be deposited. In the S. Saskatchewan, these sequences are a minimum of 5 m thick, and are overlain by 0.5-1 m of silty and muddy vertical accretion deposits. (Humphreys-ISWS)
W79-05135

MATHEMATICAL MODELING OF SEDIMENT DEPOSITION IN RESERVOIRS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Y. H. Chen, J. L. Lopez, and E. V. Richardson.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14250, p 1605-1616, December 1978. 8 fig, 1 tab, 8 ref.

Descriptors: *Backwater, *Model studies, *Reservoirs, Bed load, Rivers, Mathematical models, Sedimentation, Sediments, Streams, Dams, Deltas, Sediment deposition, Delta formation, River-reservoir system.

When a dam is constructed across a river basin to form a reservoir, the velocity of the flow in the reservoir is reduced and the sediment transported by the river is deposited. These deposits accumulate to form deltas. Estimation of the amount and location of the sediment deposits is required for engineers in the design of dams. A mathematical model was developed for prediction of the delta formation in the reservoir by considering the river-reservoir system as a whole. The river was modeled by a single channel, assuming one-dimensional flow phenomena are predominant; whereas a compound stream model approach was used to simulate the main river and the flood plains in the reservoir. The jet theory was incorporated in the mathematical model, and the resulting flow field was used to route the sediment through the reservoir. The simulated bed profiles generated by the mathematical model compared well with measured data. (Lee-ISWS)
W79-05142

SCOUR AND FILL IN A STREAM CHANNEL, EAST FORK RIVER, WESTERN WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
E. D. Andrews.
Available from OFSS, USGS, Box 25425, Fed Ctr., Denver, CO 80225, Paper copy $11.25, microfiche $3.50. Geological Survey open-file report 78-928, November 1978. 73 p, 11 fig, 6 tab, 17 ref.

Descriptors: *Scour, *Sediment transport, *Open channel flow, *Sediment distribution, *Streamflow, Flow rates, Low flow, Floods, Channel morphology, Bed load, Sedimentation rates, Discharge(Water), *Bankfull.

Frequent soundings of 11 cross sections located on the East Fork River, western Wyoming, during a spring flood revealed two sequences of channel scour and fill. All sections either scoured or filled at the flood crests relative to their low-flow condition. The sections which scoured at high flow (called scouring sections) generally tended to fill at low flow. Conversely, the sections which filled at high flow (called filling sections) generally tended to scour at low flow. The critical discharge at which the character of a section changed from scouring to filling or vice versa was approximately the bankfull discharge. Therefore, at any discharge except bankfull, some sections were accumulating bed material (fill), while others were being depleted of bed material (scour). (Woodard-USGS)
W79-05149

RECONNAISSANCE ASSESSMENT OF EROSION AND SEDIMENTATION IN THE CANADA DE LOS ALAMOS BASIN, LOS ANGELES AND VENTURA COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. M. Knott.
Geological Survey open-file report 78-873, 1978. 31 p, 15 fig, 2 tab, 16 ref.

Descriptors: *Sediment yield, *Mechanical equipment, *Accelerated erosion, *Erosion rates, Evaluation, California, *Off-road vehicles, Ventura County, Los Angeles County, Hungry Valley, Canada de Los Alamos.

An assessment of present erosion and sedimentation conditions in the Canada de Los Alamos basin, Calif., was made to aid in estimating the impact of off-road-vehicle use on the sediment yield of the basin. Evaluations were made by reconnaissance techniques and by comparing the study area with other off-road-vehicle sites in California. Major-storm sediment yields for the basin were estimated, using empirical equations developed for the Transverse Ranges and measurements of gully erosion in a representative off-road vehicle basin. Normal major-storm yields of 73,200 cubic yards would have to be increased to about 98,000 cubic yards to account for the existing level of accelerated erosion caused by off-road vehicles. Long-term sediment yield of the Canada de Los Alamos basin upstream from its confluence with Gorman Creek, under present conditions of off-road-vehicle use, is approximately 420 cubic yards per square mile per year--a rate that is considerably lower than a previous estimate of 1,270 cubic yards per square mile per year for the total catchment area above Pyramid Lake. (Woodard-USGS)
W79-05172

TRANSPORT MECHANISMS AND HYDROCARBON ADSORPTION PROPERTIES OF SUSPENDED MATTER IN LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5C.
W79-05218

MITIGATING ADVERSE ENVIRONMENTAL EFFECTS OF HIGHWAY CONSTRUCTION.
For primary bibliographic entry see Field 6G.
W79-05235

INTERDISCIPLINARY TEAM APPROACH TO MITIGATING ADVERSE ENVIRONMENTAL IMPACTS OF HIGHWAY CONSTRUCTION,
Federal Highway Administration, Sacramento, CA. California Div.
For primary bibliographic entry see Field 6G.
W79-05236

SILT BARRIERS AS EROSION POLLUTION CONTROL IN A LARGE RECREATIONAL LAKE,
Federal Highway Administration, Tallahassee, FL. Florida Div.
For primary bibliographic entry see Field 4D.
W79-05237

EFFECTIVE DEPTH IN CHANNELS HAVING BED UNDULATIONS,
Indian Inst. of Tech., Kharagpur. Dept. of Civil Engineering.
C. R. Pillai.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, Proceedings Paper 14336, p 67-81, January 1979. 11 fig, 2 tab, 14 ref, 1 append.

Descriptors: *Beds, *Channels, *Depth, Flow resistance, Friction, Hydralics, Open channel flow, Roughness(Hydraulic), Laboratory tests, Equations, Mathematics, Analysis. *Bed forms, Friction coefficient(Hydraulics), Skin friction.

Basic experimental studies were conducted in a laboratory flume to investigate the value of the depth of flow as a parameter to be used for computing the friction factor in open channels having bed undulations. The analysis of the experimental data showed that the practice of taking the depth of flow as the mean depth, on the basis of all undulations having been evened in a levelling process, needs modification since the concentration of the undulations plays a significant part. The necessary correction factor for obtaining the effective depth of flow has been suggested. It is believed that the concept of effective depth as developed in this paper would be helpful in future studies on the complex subject of flow in open channels with undulating beds. (Lee-ISWS).
W79-05254

INFLUENCE OF ROW SPACING OF GRAIN SORGHUM ON GROUND COVER, RUNOFF, AND EROSION,
Science and Education Administration, Temple, TX. Grassland, Soil and Water Research Lab.
For primary bibliographic entry see Field 3F.
W79-05258

SIZE DISTRIBUTION OF ERODED MATERIAL FROM SIMULATED RAINFALL: EFFECT OVER A RANGE OF TEXTURE,
Ghent Rijksuniversiteit (Belgium). Faculteit Landbouwwetenschappen.
D. Gabriels, and W. C. Moldenhauer.
Soil Science Society of American Journal, Vol. 42 No. 6, p 954-958, November-December 1978. 1 fig, 4 tab, 16 ref.

Descriptors: *Soil erosion, *Sediments, *Particle size, Laboratory tests, Simulated rainfall, Erosion, Soils, Soil types, Sands, Loam, Silts, Clays, Rainfall intensity, Slopes, Soil texture, Soil mechanics, Soil science, Eroded material.

Size distribution of eroded material has implications in deposition mechanics and in carrying capacity for pollutant materials. Dispersed clay stays in suspension virtually as long as water is moving. This dispersed clay, especially the expanding lattice type, has a high carrying capacity for pollutant materials. The aggregated materials high in clay settle according to size and density. The carrying capacity of aggregated materials for pollutants is assumed to be much greater than that of single-grained materials of the same size. Studies of the carrying capacities of the various sizes and compositions of aggregates are in progress. This study reported size distributions and composition of material detached by water drops and transported in shallow flow. The size distributions of aggregates and primary particles in the splashed, washed, and seal material at different times during a laboratory simulated rainfall were compared for different textured soils. The wash had more finer material than did the splash. The wash and splash material at equilibrium were not different from the original soil, while the seal of all soil had a larger silt content than the original soils. The silt loam soil had seals with about the same clay content as the original soil, while silty clay soils had seals with less clay than the original soils. Of significance from this study is the low percentage of dispersed clay being eroded compared to the percent of clay in the original soil and this percentage didn't change significantly with time. The most striking differences were between soils. These differences

were influenced mainly by texture and aggregate condition of the original soils. (Sims-ISWS)
W79-05259

NEAR-BOTTOM SEDIMENT CONCENTRATION AND FLUID VELOCITY MEASUREMENTS ON THE INNER CONTINENTAL SHELF, NEW YORK,
National Oceanic and Atmospheric Administration, Miamia, FL. Atlantic Oceanograhic and Meteorological Labs.
For primary bibliographic entry see Field 2L.
W79-05268

2K. Chemical Processes

AN EXAMPLE OF THE USE OF FACTOR ANALYSIS AND CLUSTER ANALYSIS IN GROUNDWATER CHEMISTRY INTERPRETATION,
Birmingham Univ. (England). Dept. of Geological Sciences.
For primary bibliographic entry see Field 2F.
W79-05143

GEOHYDROLOGIC DATA FROM TWENTY-FOUR TEST HOLES DRILLED IN THE PICEANCE BASIN, RIO BLANCO COUNTY, COLORADO, 1975-76,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W79-05164

DYNAMIC CHANGES IN PH AND COMPOSITION OF ABSORBED CATIONS IN IRRIGATED CHERNOZEMS OF THE TRANS-VOLGA AREA (IN RUSSIAN),
Kuybyshevskii Selskokhozyaistvennyi Inst., Kinel (USSR).
M. M. Razumova.
Pochvovedenie (7) p 81-88, 1977. English summary.

Descriptors: *Alkalinity, Sodium, *Irrigation effects, *Chermozems.

Under dry Transvolga (USSR) climate the long lasting irrigation of chernozems with water of a bicarbonate type and a periodic appearance of NaCO3, increased the alkalinity of irrigated soils. The increased alkalinity disturbed the usual composition of cations in soil adsorbing complex of chernozems and changed the adsorbing properties and the energy of adsorption of the main cations: Ca, Mg and Na.-Copyright 1978, Biological Abstracts, Inc.
W79-05226

CALCITE AS A SOURCE OF EXCESS CALCIUM IN RAINWATER,
Tokyo Inst. of Tech. (Japan). Dept. of Environmental Chemistry.
M. Ichikuni.
Journal of Geophysical Research, Vol. 83, No. C12, p. 6249-6252, December 20, 1978. 1 fig, 2 tab, 18 ref.

Descriptors: *Chemistry of precipitation, *Precipitation(Atmospheric), *Rainfall, *Snowfall, Chemicals, Chemical analysis, Sodium, Potassium, Magnesium, Calcium, Strontium, Calcite, Foreign countries, Foreign research, Calcium compounds, Dusts, Seawater, Sampling, Meteorology, *Japan, *Sendai(Japan), *China.

Snow and rain samples collected in Sendai, Japan, were analyzed for sodium, potassium, magnesium, calcium, and strontium. The chemical composition of the samples can be explained by adding some calcium to diluted seawater. A low Sr/Ca ratio in most of the samples showed that the excess calcium over seawater contribution may be derived from calcite contained in soil dust transported by wind from North China. (Sims-ISWS)
W79-05262

CHLORINE DEGRADATION AND HALOCARBON PRODUCTION IN ESTUARINE WATERS,
Maryland Univ., College Park. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W79-05451

INVESTIGATION OF HALOGENATED COMPONENTS FORMED FROM CHLORINATION OF MARINE WATER,
Batelle Pacific Northwest Lab., Richland, WA.
For primary bibliographic entry see Field 5A.
W79-05452

THE EFFECT OF AMMONIA CONCENTRATION ON THE CHEMISTRY OF CHLORINATED SEA WATER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5A.
W79-05453

MICROBIAL DEGRADATION OF HALOGENATED HYDROCARBONS,
Texas Univ. at Austin. Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W79-05454

2L. Estuaries

DIATOM COMMUNITY STRUCTURE: TAXONOMIC AND STATISTICAL ANALYSES OF A MISSISSIPPI SALT MARSH,
Mississippi State Univ., Mississippi State. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W79-05007

MOBILE BAY HYDROGRAPHY UNDER FLOOD STAGE CONDITIONS,
Alabama Univ., University. Dept. of Chemical and Metallurgical Engineering.
G. C. April, S. Hu, S. Ng, and C. E. Brett.
In: Coastal Zone 78, Symposium on Technical, Environmental, Socio-Economic and Regulatory Aspects of Coastal Zone Planning and Management, March 14-16, 1978, San Francisco, California. p 1783-1802, 10 fig, 3 tab, 8 ref. OWRT A-061-ALA(1).

Descriptors: *Discharge, *Mathematical modeling, *Flood stages, Flood discharge, Mobile River Basin.

The impact of flood stage river discharges from waters in the Mobile River Basin on water movement and level in Mobile Bay is assessed using mathematical modeling methods. Water elevations and variations in the salinity content of the bay waters are reported for flood conditions occurring between March and May of 1973. This period was selected for purposes of comparing the model results with available field data collected during that period. Comparisons with normal discharge conditions are also made in the study. Wind direction and speed are included in the analysis.
W79-05008

COMPUTATION OF SHALLOW WATER WAVES WITH HYBRID FINITE ELEMENTS,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hydromechanik.
B. Herrling.
Advances in Water Resources, Vol. 1, No. 6, p 313-320, December 1978. 16 fig, 16 ref.

Descriptors: *Waves(Water), *Water circulation, *Shallow water, *Model studies, Mathematical models, Hydraulic models, Finite element analysis, Water levels, Depth, Turbulence, Eddies, Velocity, Circulation, Fluid mechanics, Estuaries.

The numerical computation of two-dimensional, incompressible, long-period, shallow water waves using the method of finite elements was presented. It was shown that the set of equations solved in each time step is reduced to 1/3 the usual size by satisfying the equations of motion on the element level only (hybrid finite elements). The water levels in all nodes are the sole parameters computed from the set of equations. The velocities were calculated subsequently on the element level in each time step. Special emphasis was placed on reproducing eddies behind corners using an anisotropic turbulent exchange tensor. (Sims-ISWS)
W79-05022

HYDROGEOLOGY OF BERMUDA--SIGNIFICANCE OF AN ACROSS-THE-ISLAND VARIATION IN PERMEABILITY,
Washington State Univ., Pullman. Dept. of Geology.
H. L. Vacher.
Journal of Hydrology, Vol. 39, No. 3/4, p 207-226, December 1978. 6 fig, 30 ref.

Descriptors: *Hydrogeology, *Islands, *Groundwater movement, *Permeability, *Mathematical models, *Tidal effects, Saline water-freshwater interfaces, Dupuit-Forchheimer theory, Water level fluctuations, Sea level, Shores, Limestones, Zone of saturation, Sea water, Water table, Submergence, Geochemistry, Model studies, *Bermuda, *Ghyben-Herzberg lens, Infinite strip model, Transition zone, Asymmetry, Amplitude.

The distribution of fresh groundwater in Bermuda reflects the lateral partitioning of the saturated zone into two sectors: a band of low-permeability limestones (Paget Formation) along one shoreline, and a band of older, more highly permeable limestones (Belmont Formation) along the opposite shoreline. The fresh groundwater occurs preferentially closer to the shoreline composed of Paget Formation. The an-axisymmetric distribution of fresh groundwater results from the effects of the across-the-island variation of permeability on the interface-bounded lens (the theoretical Ghyben-Herzberg lens) and the transition zone, which, in Bermuda, makes up a sizable fraction of the interface-bounded lens. The variation in size of the interface-bounded lens can be modeled closely by application of Ghyben-Herzberg-Dupuit methodologies to an infinite-strip vertically stratified island. The occurrence of fresh groundwater in Bermuda reflects the depositional and diagenetic history of the Pleistocene marginal-marine limestones that compose Bermuda. As a result of these processes operating during a period of large-scale sea level fluctuations, older (intra-Belmont) intereolianite depressions have evolved through a marsh stage and are now interior sounds. The results is the across-the-island variation in permeability. (Visocky-ISWS)
W79-05031

NUMERICAL MODEL OF THE CIRCULATION IN AN OPEN BAY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Dept. of Fisheries and the Environment.
B. Petrie, and K. Drinkwater.
Journal of the Fisheries Research Board of Canada, Vol. 35, No. 12, p 1631-1635, December 1978. 5 fig, 11 ref, 1 append.

Descriptors: *Water circulation, *Bays, *Currents(Water), *Canada, *Mathematical models, Coasts, On-site investigations, Model studies, Numerical analysis, Analytical techniques, Analysis, *Nova Scotia, *St. George Bay(Nova Scotia), Gyre.

This note briefly reviewed the experimental results that indicate the presence of a mean clockwise circulation in St. Georges Bay, proposed a possible mechanism for driving the gyre, and presented the results of a numerical study of a model open bay. St. Georges Bay, Nova Scotia, is approximately 30 x 30 km, has a mean depth of about 30 m, and is open at its northern end to the Northumberland Strait and the Gulf of St. Lawrence. In 1974 and 1975, a program of current meter moorings and hydrographic measurements was conducted as part of a study of the fisheries and physical oceanography of the bay. An external alongshore current

setting to the east and across the mouth is proposed as the driving mechanism for the measured clockwise circulation in St. Georges Bay, Nova Scotia. A barotropic numerical model of an open bay forced by an alongshore current was able to produce a clockwise gyre in the bay. The model current velocities were in good agreement with the data. The generation, size, and intensity of the gyre required low values of vertical viscosity relative to horizontal viscosity. (See also W78-12163) (Humphreys-ISWS)
W79-05134

CONCEPTUAL REVIEW AND PRELIMINARY DESIGN OF MULTIFARIOUS WATER INTAKE STRUCTURES,
Polytechnic Inst. of New York, Brooklyn. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 8A.
W79-05248

DATA FILE: NEW BEDFORD HARBOR, MASSACHUSETTS,
Woods Hole Oceanographic Institution, MA.
J. P. Ellis, B. C. Kelley, P. Stoffers, M. G. Fitzgerald, and C. P. Summerhayes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 199, Price codes: A05 in paper copy, A01 in microfiche. Report No. WHOI-77-73, December 1977. 85 p, 4 fig, 16 tab, 9 ref. NOAA 04-6-158-44016, 04-6-158-44106.

Descriptors: *Massachusetts, *Harbors, *Data collections, Oceanography, Water quality, Sediments, Biology, Aquatic life, Biomass, Chemistry, Bottom sampling, Suspended solids, Analysis, Size, Particle size, Estuaries, Wastes, Dispersion, Heavy metals, Carbon, Nitrogen, On-site data collections, On-site investigations, *New Bedford Harbor(MA), Accumulation, Fine-grained sediments, Sea grant program.

The purpose of this data file was to make available most of the basic data that was collected as part of Woods Hole Oceanographic Institution's study of New Bedford Harbor. The New Bedford Harbor project was designed to examine the past and present patterns of dispersal and accumulation of fine-grained sediments and waste materials in New Bedford Harbor and its approaches. The report was divided into five sections, each dealing with one of the major aspects of the study. The sections are: water quality data, suspended matter, bottom sample locations and size analysis data, chemical data, and biological data. (Froehlich-ISWS)
W79-05249

ACOUSTIC MONITORING OF INDUSTRIAL CHEMICAL WASTE RELEASE AT DEEP WATER DUMP SITE 106,
Woods Hole Oceanographic Institution, MA. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 5B.
W79-05264

THE ANATOMY OF THE ANTARCTIC POLAR FRONT IN THE DRAKE PASSAGE,
Woods Hole Oceanographic Institution, MA.
T. M. Joyce, W. Zenk, and J. M. Toole.
Journal of Geophysical Research, Vol 83, No C12, p 6093-6113, December 20, 1978. 21 fig, 2 tab, 27 ref, 1 append. NSF OCE75-14-56, OCE77-82036.

Descriptors: *Water temperature, *Salinity, *Density, *Antarctic, *Antarctic Ocean, On-site investigations, On-site data collections, Dissolved oxygen, Waves(Water), Mixing, Heat flow, Heat transfer, Mathematical models, Spatial distribution, Chemicals, Water chemistry, Cold regions, Oceanography, *Drake Passage, *Antarctic Polar Fronts, Fronts(Water).

An intensive, three-dimensional survey of the Antarctic Polar Front was made in the Drake Passage in March 1976. The front, which was imbedded within one of the high-velocity cores of the circumpolar current, was viewed as a water mass boundary demarking the northern extent of near-surface antarctic waters. Within the front, water masses were observed to intrude, one above the other, with characteristic vertical scales of 50-100 m. The intrusions were horizontally anisotropic, being elongated in the along-stream direction and constrained primarily to the upper 800 m of the front. The spatial and temporal persistence of the variability was examined through the analysis of continuous vertical profiles of horizontal velocity, temperature, salinity, and oxygen with discrete sampling of nutrients. Analysis of the velocity data showed the mean current flowing to the NNE with speeds of the order of 30-40 cm/s in the upper 600 m, with total variability over a 28-hour 'yo-yo' due primarily to internal gravity waves. The thermohaline variability was not internal-wave induced, but rather it was associated with nearly isentropic advection of different water masses across the front. Cold fresh and warm salty intrusions did not conserve potential density, however, and double-diffusive transfers are strongly suggested as being crucial to an understanding of the dynamics of the intrusions. Applying a model for lateral mixing, poleward temperature and salinity fluxes due to interleaving of 0.086 C cm/s and 0.069 parts per thousand cm/s, respectively, were estimated. If these values are typical, interleaving could play a significant role in large-scale balance of salt and, to a lesser extent, heat for the Southern Ocean. (Sims-ISWS)
W79-05265

WIND-INDUCED CURRENT FLOW IN THE UPPER HUDSON SHELF VALLEY,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
T. A. Nelson, P. E. Gadd, and T. L. Clarke.
Journal of Geophysical Research, Vol. 83, No. C12, p 6073-6082, December 20, 1978. 12 fig, 2 tab, 27 ref.

Descriptors: *Winds, *Currents(Water), *Continental shelf, *Atlantic Ocean, *Model studies, Mathematical models, Current meters, Flow, Turbidity, Suspended solids, Remote sensing, Water circulation, Ocean circulation, Channels, Coasts, Estuaries, *Hudson Shelf Valley, *New York Bight.

Drawing from wind and current meter data, an empirical, semiquantitative model was developed for wind-induced current flow in the New York Bight apex portion of the Hudson Shelf Valley. Data showed that winds from 270 deg T (+ or -50 deg), blowing for at least 9 hours at speeds of greater than 5 m/s, can cause northward (upchannel) bottom flow in the shelf valley at velocities in excess of 40 cm/s. Southern (downchannel) flow was initiated by winds from 75 deg T (+ or -35 deg) blowing for at least 6 hours at speeds of 4 m/s or more. Seasonal variation in the wind field resulted in predominant upchannel flow during October-April with downchannel flow throughout the rest of the year. (Sims-ISWS)
W79-05266

WAVE-CURRENT INTERACTION MODELS FOR RIP CURRENTS,
Delaware Univ., Newark. Dept. of Civil Engineering; and Delaware Univ., Newark. Coll. of Marine Studies.
R. A. Dalrymple, and C. J. Lozano.
Journal of Geophysical Research, Vol. 83, No. C12, p 6063-6071, December 20, 1978. 5 fig, 2 tab, 30 ref, 1 append.

Descriptors: *Rip currents, *Waves(Water), *Shores, *Model studies, Mathematics, Foreign research, On-site data collections, Beaches, Foreign countries, Coasts, Ocean waves, Mathematical models, Currents(Water), Equations, *Isle of Sylt(West Germany), Wave-current interactions.

Two analytic models were developed to describe rip current cells on an open coastline with sloping planar foreshore and flat offshore bathymetry. Both models extended the work of LeBlond and Tang to include the refraction of the normally incident wave field by the nearshore circulation. The first model included the effect of the currents on the incident wavelength, but no change in wave direction, and showed that no rip currents are possible. The second, more complete model considered the refraction of the waves as well and predicted rip current cells. The spacing of the rip currents and their associated variables were shown to be a function of one dimensionless parameter. Comparison of the predicted spacing with some published field data as well as with measurements obtained on the Isle of Sylt, West Germany, showed reasonable agreement with the second model. (Sims-ISWS)
W79-05267

NEAR-BOTTOM SEDIMENT CONCENTRATION AND FLUID VELOCITY MEASUREMENTS ON THE INNER CONTINENTAL SHELF, NEW YORK,
National Oceanic and Atmospheric Administration, Miamia, FL. Atlantic Oceanograhic and Meteorological Labs.
J. W. Lavelle, R. A. Young, D. J. P. Swift, and T. L. Clarke.
Journal of Geophysical Research, Vol. 83, No. C12, p 6052-6062, December 20, 1978. 15 fig, 19 ref.

Descriptors: *Sediments, *Currents(Water), *Continental shelf, *New York, *Atlantic Ocean, Turbidity, Suspended solids, Instrumentation, Current meters, On-site investigations, On-site data collections, Ocean currents, Ocean circulation, Water circulation, Velocity, Winds, Tides, Tidal effects, Oceanography.

Prototype instrumentation designed to measure light scattering and transmission and the horizontal components of fluid velocity at a point 100 cm off the sea floor 1976. Depth at the point of deployment was 10.5 m. Data were taken from sensors in hourly bursts consisting of 468 consecutive 1-s samples. Measurements taken with the electromagnetic current sensor were converted to absolute units by using a laboratory calibration, while absolute calibration of the turbidimeter in terms of suspended matter concentration was accomplished by using a combination of laboratory and field measurements. The results from the deployment showed the effects of water motions at both wave and subtidal frequencies on sediment concentrations. Although burst mean fluid motions during the observation interval were primarily of tidal frequency, a single wind-forced event caused burst mean currents in excess of 38 cm/s. During that same event, suspended particulate concentrations rose to a burst mean of 79 mg/l from a prestorm level of 5 mg/l, an order of magnitude increase occurring over a period of approximately 12 hours. During the storm event, individual burst records showed that fluid motions at surface wave frequencies and with amplitudes of over 100 cm/s occurred at the experimental site. The near-bottom suspended matter field at that time was found to have appreciable energy at surface wave frequencies as well. Changes in suspended matter concentration of the order of 130 mg/l were observed to occur in a period of 3-5 s. Increased burst mean concentration was seen to accompany increased wave activity, although increased mean flow with declining wave activity also led to increased suspended particulate concentration. (Sims-ISWS)
W79-05268

ALGAE OF SALTMARSHES ON THE SOUTH AND SOUTHWEST COASTS OF ENGLAND,
Katholieke Univ., Nijmegen (Netherlands). Lab. voor Aquatische Oecologie.
For primary bibliographic entry see Field 5C.
W79-05335

MEASUREMENT AND SIGNIFICANCE OF SPECIFIC ACTIVITY IN THE HETEROTROPHIC BACTERIA OF NATURAL WATERS,
Gordon Coll., Wenham, MA. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-05490

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF DRY-RO MEMBRANES FROM SULFONATED CELLULOSE ACETATES AND QUATERNIZED CELLULOSE ACETATE CARBAMATES,
Chemical Systems Inc., Tustin, CA.
R. E. Kesting.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 144, Price codes: A03 in paper copy, A01 in microfiche. Final Report (1978). 40 p, 9 fig, 19 tab, 34 ref. OWRT 7520(1). 14-34-0001-7520.

Descriptors: *Membranes, Filtration, *Reverse osmosis, Sulfonates, Cellulose triesters.

The program treated two aspects of ionogenic cellulosic reverse osmosis membranes: (1) The feasibility of incorporating anionic (sulfonate groups) charges into cellulose acetate (CA); and (2) the feasibility of the covalent attachment of quaternary ammonium groups via carbamate- rather than ester-linkages. The synthesis of anionic cellulose triesters (ACTEs), i.e. sulfonated CAs reacted the free OH groups of CA with o-sulfobenzoic anhydride. Precipitation of this polymer into aqueous sodium bicarbonate produced the sodium salt. The addition of the anhydride to CA was found to be nearly quantitative. Permeability increased with increasing ion exchange capacity (I.E.C.). The synthesis of aliphatic sulfonates was effected via sodium bisulfite addition to CA mixed esters containing terminal olefinic groups, e.g. CA undecylenate. Membranes of the sodium salt of CA 11-sulfoundecanoate were the best developed on the ACTE program. ACTE development may be the preferred path for future cellulosic RO membrane development. The second part of the program resulted in the simplified approach of in situ formation of CA carbamates. This revolutionary approach consisted of preparing blocked isocyanate monomers bearing quaternary ammonium groups and the inclusion of these monomers in ordinary CA casting solutions such that they wound up incorporated within the final membrane.
W79-05045

BRACKISH WATER CONVERSION DEMONSTRATION PLANT NO. 4, ROSEWELL, NEW MEXICO: THIRD ANNUAL REPORT.
American Hydrotherm Corp., NY.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-185 738, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 254, March 1967. 151 p, 25 fig, 10 tab, 9 ref, 3 append. 14-01-0001-322.

Descriptors: *Desalination plants, *Demonstration Plant No. 4, *Forced circulation vapor compression distillation, Capital costs, Operating costs, Operation and maintenance, Evaporators, Desalination apparatus, Distillation, Scaling, Corrosion, Corrosion control, Ion exchange, Brackish water, Equipment, Valves, Tubes, Pipes, Roswell(New Mexico).

The Brackish Water Conversion Demonstration Plant No. 4 at Roswell, New Mexico, a forced circulation vapor compression distillation plant, was operated entirely for the purposes of development during 1966. The work was carried out (1) to eliminate scale formation in the evaporators, (2) to improve equipment performance and reliability, and (3) to resolve corrosion problems. Calcium sulfate, the major scale constituent, was eliminated through modifying the ion exchange equipment and changing the process concentration factor. Metal corrosion from contact with brackish water causes leaks which require frequent shutdowns for repairs. Corrosion products cause tube plugging, influence scale formation in the evaporators, and affect the mechanical performance of the vapor compressor and valves. Improvements to eliminate these problems included the installation of (1) a cathodic protection system in the second evaporator, and (2) new material for evaluation in the feed pipes and heat exchange tubes. Significant modifications were made on the ion-exchange, vapor compressor, and evaporators to improve performance and reduce maintenance requirements. Demonstration plant capital and operating costs, and theoretical capital and operating costs for a normalized plant are presented in addition to monthly production and cost figures. A general discussion of vapor compression distillation includes information on energy costs; energy requirements; pressure level and temperature span for compression; and energy requirement and cost using multiple effects. (Davison-IPA)
W79-05070

ACID MINE WATER REVERSE OSMOSIS TEST AT KITTANNING, PENNSYLVANIA,
General Dynamics Co., San Diego, CA.
A. Riedinger, and J. Schultz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-184 073, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 217, October 1966. 72 p, 25 fig, 18 tab, 1 ref, 2 append. 14-01-0001-752.

Descriptors: *Desalination apparatus, *Acid mine water, *Reverse osmosis, Membranes, Membrane processes, Dissolved solids, Desalination processes, Coal mine wastes, Liquid wastes, Water pollution sources, Water treatment, Water quality, Water quality control, On-site tests, Equipment, Sulfur compounds, Calcium sulfate, Reverse Osmosis Test Unit Pogo I, Kittanning(Pennsylvania).

A field test of the Reverse Osmosis Test Unit Pogo I, operating with two acid mine drainage water feeds in Pennsylvania, was performed to examine the effectiveness of reverse osmosis in concentrating and reclaiming acid drainage from coal mines, and to obtain information to be used in planning future test programs. Various modes of operation and spiral-wound module types were used in tests conducted on a 24-hour/day basis for 10 days. The mine waters tested contained about 2000 ppm total dissolved solids, which were principally calcium sulfate, magnesium sulfate, and ferrous sulfate. Approximately 1100 gallons/day of high quality product water were produced. Operation was maintained over periods of several days with recovery rates at over 90%, although the solubility limits for some constituents were exceeded. The waste brine produced was smaller in volume than the original input feed, and its acid content was highly concentrated. It is concluded that in a highly acidic calcium sulfate, magnesium sulfate water can most likely be concentrated beyond saturation; precautions to avoid aeration of the water may be required when the water contains 100 ppm or more of ferrous iron; and sufficient data was collected to permit the design of a pilot plant to treat acid water inn which Type A membranes would be more desirable than Type C. (Davison-IPA)
W79-05071

THE OAK RIDGE NATIONAL LABORATORY CONCEPTUAL DESIGN OF A 250-MGD DESALINATION PLANT.
Oak Ridge National Lab., TN.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-189 436, Price codes: A18 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 214, September 1966. 300 p, 104 fig, 42 tab, 88 ref, 9 append. 14-01-0001-534.

Descriptors: *Desalination plants, *Multistage flash distillation, *Design criteria, Evaporators, Desalination, Sea water, Electrical equipment, Instrumentation, Heat transfer, Facilities, Operation and maintenance, Costs, Capital costs, Cost analysis, Intake structures, Pumps, Pipes, Valves, Technology.

An in-depth study of the economic and engineering factors affecting the cost and performance of a 250 mgd multistage flash process sea water evaporator is reported. The technology reported is based on plant start up about 1975, and the reference evaporator is presumed to be coupled to a heavy-water-moderated organic-cooled reactor having a heat output of 3300 Mw and a gross electrical output of 675 Mw. The plant, designed for 30 years of service, provides a performance ratio of 1016 of water/1000 Btu, a maximum brine temperature of 250F, and a primary heat exchanger surface of 70% copper and 30% nickel allow tubing. Computer-based parametric studies were made relating to steam temperature, steam cost, performance ratio, and plant size to the cost of water. Water costs are based on cost equations in which the cost of steam and power vary with water plant capacity and performance ratio. Plant descriptions include single effect and multieffect, multistage designs. The following plant system and components are described: sea water intake system, chemical control systems, deaeration system, brine heaters, evaporator assembly, heat transfer, evaporator structure, demisters, pumps and drives, piping and valves, materials selection, instrumentation and controls, electrical system, plant facilities, operation and maintenance procedures, and site and design criteria. The appendexes contain reference plant drawings. (Davison-IPA)
W79-05072

ANALYSIS AND OPTIMIZATION OF A REVERSE OSMOSIS WATER PURIFICATION SYSTEM,
Kansas Engineering Experiment Station, Manhattan.
L. T. Fan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-183 991, Price codes: A02 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 332, January 1968. 22 p, 11 fig, 23 ref.

Descriptors: *Desalination processes, *Reverse osmosis, *Systems analysis, *Optimization, Economics, Mathematical studies, Costs, Economic feasibility, Boundary layers, Reynolds Number, Capital costs, Operating costs, Design data.

A summary of the utilization of systems analysis procedures to model and optimize an entire reverse osmosis system is presented. Water production rate is related to operating pressure, Reynolds Number, and membrane area through the use of a boundary layer flow model. Cost equations relating capital and operating costs to the design variables are developed, and used in economic optimization studies of several reverse osmosis studied. The optimal conditions for three stage systems were determined using the discrete version of the maximum principle along with search procedures. The optimal pressure, Reynolds Number, and ratio of membrane to feed flow rate were determined. The optimal results for three cases are tabulated: (1) a three stage process with a turbine for depressurization; (2) a three stage process with a flow work exchanger; and (3) a three stage system with an equal membrane area to feed flow ratio in each stage. The results show minimum costs for the three stage system with the depressurization turbine to be $.44/1000 gallons, $.37/1000 gallons for the three stage system with a flow work exchanger, while comparable costs for a one stage system with a turbine for depressurization are $.49/1000 gallons, and $.39/1000 gallons for an on stage system with a flow work exchanger. It is concluded that modern optimization procedure, i.e., discrete version of the maximum principle combined with search techniques, can be used in optimizing reverse osmosis desalination systems. Details of this study, including the derivation of the formulae, are contained in: 'Analysis and Optimization of a Reverse Osmosis Water Purification System; Special Report No. 73'. (Davison-IPA)
W79-05073

COST ANALYSIS OF SIX WATER DESALTING PROCESSES,
Stanford Research Inst., Menlo Park, CA.
C. F. Clark.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB-200 908, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 495, November 1969. 108 p, 25 fig, 25 tab, 58 ref. 14-01-0001-2236.

Descriptors: *Desalination processes, *Capital costs, *Multistage flash distillation, Vertical tube evaporator, Vapor compression distillation, Vacuum-freeze vapor compression. Reverse osmosis, Electrodialysis, Amortization, Equipment, Indirect costs, Design data, Brackish water, Saline water, Water treatment, Water purification, Desalination plants.

The capital cost requirements and cost of producing fresh water were determined for the following six desalination processes which are currently considered most economically favorable for application within the U.S.: (1) multistage flash distillation (MSF); (2) vertical tube evaporator (VTE) combined with MSF; (3) vapor compression distillation (VC) combined with VTE and MSF; (4) vacuum-freeze vapor compression (VFVC); (5) reverse osmosis (RO); and electrodialysis (ED). The ground rules for the study, established by the Office of Saline Water, include plant capacity, equipment amortization, indirect capital costs, recurring costs, supplies and maintenance materials, energy unit costs, and chemical costs. The land costs used in preparing the estimates were $100,000/acre for sea coast locations, and $25,000/acre for inland brackish water plants. The cost of feed water intake and brine disposal lines were not included for sea water conversion plants, and no prevision was made for the cost of collecting feed water or disposal of the brine concentrate for plants using brackish feed water. The major cost elements for each process are identified, and the effects of varying process parameters on water costs are shown for each. Plant designs for each process are presented, and the future development of each is discussed. The results of the unit costs of the important process variables are presented in graphical form. (Davison-IPA)
W79-05074

A STUDY OF DESALTING PLANTS (15 TO 150 MGD) AND NUCLEAR POWER PLANTS (200 TO 1500 MWT) FOR COMBINED WATER AND POWER PRODUCTION.
Catalytic Construction Co., Philadelphia, PA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 396, Price codes: A17 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 124, November 1964. 325 p, 35 fig, 76 tab, 21 ref, 8 append. 14-01-0001-367 and AT (30-1) 3316.

Descriptors: *Desalination plants, *Electric powerplants, *Nuclear reactors, *Multistage flash evaporation, *Steam turbines, *Fossil fuels, Natural gas, Costs, Capital costs, Water rates, Electric power costs, Economics, Cost comparisons, Electric power production.

The results of an economic analysis of combination plants which produce electric power and potable water from sea water are presented. In these plants, high pressure steam is fed to a turbo-generator to produce electric power; low pressure steam is exhausted from the turbine and condensed in the brine heaters of a multistage flash evaporation water desalination plants. Two types of steam supply systems, nuclear reactors and conventional, natural gas-fired boilers, were studied. The nuclear reactors are in two classes: a low temperature type which produces saturated steam at 500 to 600F, and a high temperature type which produces steam at 1000F. Two classes of fossil fuel plants were hypothesized, delivering steam at comparable conditions with the nuclear reactors. Intermediate sized plants ranging from 200 to 1500 MWt input were examined, and calculations were conducted at 200, 600, 1000, and 1500 MWt. Calculations were also made to determine the cost of producing water in single purpose water-only plants. Water costs are tabulated for the various dual purpose and water-only plants. Where plant size, energy source, fixed charge rate, and the power credit factor are equal, water is more economically produced by dual purpose plants. The results indicate that small sized fossil fuel plants with higher fixed charge rates are competitive due to the higher capital cost requirements of nuclear reactors. Low temperature systems are favored where the plant capacity is low with a low power credit factor and a high fixed charge rate. (Davison-IPA)
W79-05075

AN ENGINEERING EVALUATION OF THE LONG-TUBE VERTICAL FALLING-FILM DISTILLATION PROCESS.
Dow Chemical U.S.A., Freeport, TX. Texas Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 202, Price codes: A14 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 139, February 1965. 294 p, 35 fig, 37 tab, 54 ref, 3 append. 14-01-0001-397.

Descriptors: *Desalination plants, *Demonstration Plant No. 1, *Evaluation, *Design, *Long-tube vertical multiple effect distillation, Falling-film, Equipment, Sampling, Chemical analysis, Design criteria, Evaporators, Desalination apparatus, Desalination processes, Freeport(Texas).

An extensive engineering study was undertaken to evaluate Demonstration Plant No. 1 in Freeport, Texas. The plant is a long-tube, vertical, falling-film, multiple-effect distillation type and has been successfully operated for three years. Heat and material balances for three sets of operating conditions were calculated. The preheaters and cross exchangers were evaluated for the current operation, and designed for two others. Sampling and chemical analysis were included in the study of the deaerator and its operation. The evaporator design was assessed under three sets of conditions for varying tube sizes and brine recirculation rates. The present operation of the entrainment-separator design was evaluated, and the use of wire mist eliminators was studied. Construction materials and corrosion problems of the plant were studied; samples were examined, and radio logs were taken. The pumps, mechanical equipment and plant instrumentation were also evaluated. Nine major conclusions are presented; specific conclusions are contained throughout the report. Among the major conclusions are: the most economical process is the operation of the plant at an Effect I temperature of 300F with ion exchange softening of the sea water feed; with the process improvements determined by this evaluation, a normalized 1 mgd plant was designed at a capital cost of $1,518,570 to operate for $1.16/1000 gallons; and the first effect temperature should not exceed 240F to prevent anhydrite formation, and to prevent gypsum formation, the last effect concentration factor should not exceed three times normal sea water. (Davison-IPA)
W79-05076

RESULTS OF A PRELIMINARY SURVEY OF CANDIDATE COMMUNITIES FOR SALINE WATER DEMINERALIZATION APPLICATIONS.
Black and Veatch, Kansas City, MO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-173 673, Price codes: A17 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 162, March 1966. 396 p, 1 fig, 2 tab. 14-01-0001-320.

Descriptors: *Desalination, *Surveys, *Demineralization, *Water resources development, *Cities, *Water requirements, Water supply, Saline water, Brackish water, Water wells, Available water, Water resources, Water demand, Water utilization, On-site investigations, Sea water, Groundwater, Surface water availability.

In Phase I of a two phase report, 10,000 communities were screened as to the feasibility of saline water conversion on the basis of the following criteria: (1) community growth, (2) no existing supply plant, (3) ample rainfall areas, (4) ample fresh water source, (5) saline source, sea water, and (6) saline source, inland ground and surface supplies. This screening indicated about 2,800 communities where saline conversion might be applicable, and a questionnaire was prepared to establish the adequacy of fresh water sources to supply present and future needs and to determine the availability of saline water sources for potential supplies. The questionnaire information was evaluated and used with data compiled from state and Federal agencies to select 180 communities/water utilities as candidates for saline water demineralization applications. These candidate-communities are summarized in tabular form. In Phase II the existing water situation was evaluated, and the availability of fresh and/or saline water sources in the 180 communities was assessed. On-site investigations of each community were conducted and interviews were made in communities located in water supply problem areas. A field investigation was carried out to ascertain current annual water requirements. Field contacts in addition to interviews with municipal and utility officials of the selected 180 communities are listed. (Davison-IPA)
W79-05077

THIRD ANNUAL REPORT: BRACKISH WATER CONVERSION DEMONSTRATION PLANT, WEBSTER, SOUTH DAKOTA.
Mason-Rust, Louisville, KY.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-178 310, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 164, September 1965. 98 p, 11 fig, 14 tab, 1 append. 14-01-001-225.

Descriptors: *Desalination plants, *Evaluation, *Brackish Water Conversion Demonstration Plant No. 3, *Electrodialysis, Desalination processes, Scaling, Equipment, Capital costs, Operating costs, Desalination apparatus, Water treatment, Water quality, Water quality control, Pretreatment(Water), Brackish water, Webster(South Dakota).

Plant maintenance, operational history, and technical, economic, and administrative evaluations of the Brackish Water Conversion Demonstration Plant No. 3 in Webster, South Dakota, are reported for July 1, 1964 through June 30, 1965. General membrane scaling, selective scaling of the cathode area, poor process performance with water from well number five, stack resistance instability, and pretreatment deficiencies remain the areas of concern. Equipment failures included the iron/manganese pretreatment system. Capital and operating costs for Demonstration Plant No. 3 are compared with normalized capital and operating costs for electrodialysis plants with capacities of 250,000; 1,000,000 and 2,000,000 gallons/day. Direct and indirect monthly operating costs and the corresponding monthly water production are tabulated. These costs were influenced by the downtime required by equipment modifications, and failures. (Davison-IPA)
W79-05078

OPERATION AND MAINTENANCE OF 37,000 GPD THIN-FILM DISTILLATION PILOT PLANT.
General Electric Co., Burlington, VT.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-180 060, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 181, April 1966. 78 p, 48 fig, 3 tab. 14-01-0001-248.

Descriptors: *Desalination plants, *Desalination apparatus, *Pilot plants, *Testing, On-site tests, Research and development, Equipment, Evaluation, Evaporators, Heat exchangers, Thin films, Valves, Sea water, Distillation, Wrightsville Beach(North Carolina).

Pilot plant equipment testing and maintenance at the Research and Development Test Station located at Wrightsville Beach, North Carolina, are reported for May 1963 through June 1965. Pilot plant equipment consists of: double-fluted tube evaporator, wiped-film evaporator, deaerator, six

heat exchangers, seven pumps, two steam reducing valves, level controllers, switchgear, salinity measuring equipment, and pH measuring equipment. The data from single-effect and double-effect test runs are discussed and illustrated by graphic representations. The second-effect evaporator was modified to become a 10-ft long double-fluted tube thin-film evaporator. The conclusions resulting from the test program include: (1) the thin-film process of evaporation distillation is adaptable to intermediate and large size multiple-effect plants for converting seawater to fresh water; (2) the fluted tube design is an advanced method for obtaining thin films and high heat transfer rates through a metal barrier; (3) the five and ten foot double fluted tubes can be advantageously incorporated into the large multiple-effect evaporator design; (4) deaeration of the sea water to low values of oxygen content is feasible with the proper design of the stripping vessel; and (5) scale prevention utilizing pH control at temperatures through 275F is possible over long periods with normal brine concentrations in the thin film process. (Davison-IPA)
W79-05079

RESEARCH ON AND ANALYSIS OF SINGLE-EFFECT LOW TEMPERATURE FLASH EVAPORATION PROCESS.
Baldwin-Lima-Hamilton Corp., Philadelphia, PA. Industrial Equipment Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 393, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 18. (1957). 70 p, 24 fig, 12 tab, 7 ref. 14-01-001-90.

Descriptors: *Desalination plants, *Design crtiteria, *Evaluation, Research and development, Estimated costs, Engineers' estimates, Water rates, Pumps, Laboratory tests, Flash distillation, Desalination processes, Water purification, Industrial wastes, Liquid wastes, Feasibility studies.

Design studies of single stage flash evaporators utilizing the heat in waste streams from power plants, oil refineries, industrial plants, or natural streams were made. Preliminary designs and cost estimates were based on temperature differences of 15 and 30F between the heated water and the available cooling water. The two studies made for each of these temperature differences were for plants with 1,000,000 and 10,000,000 gpd capacity, and included conception of ideas, rough sketches, rating calculations, design and detail drawings for cost estimations, and arrangement drawings. The final drawings are contained in the report. Information on air removal methods and quantities of air to be removed from low pressure flash distillation apparatus was obtained through literature studies, direct contact with equipment venders, and laboratory tests on dissolved gases. It is concluded that: low temperature flash evaporation of warm saline waters is theoretically sound, technically feasible, and proven by actual installations which have been operating for years; water could be produced by this process for about $1.20/1000 gallons in a 10,000,000 gpd plant, and about $1.75/1000 gallons in a 100,000 gpd plant; and none of the pumps selected for removing air from evaporators was ideally suited, and a final selection must be based on an evaluation of the local conditions and economics for individual plants. (Davison-IPA)
W79-05080

AN ENGINEERING EVALUATION OF THE ELECTRODIALYSIS PROCESS ADAPTED FOR COMPUTER METHODS FOR WATER DESALINATION PLANTS.
Mason-Rust, Webster, SD.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 077, Price codes: A11 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 134, February 1965. 246 p, 37 fig, 13 tab, 52 ref, 2 append. 14-01-0001-437.

Descriptors: *Desalination plants, *Evaluation, *Engineering, *Electrodialysis, *Computer programs, Mathematical studies, Economic feasibility, Brackish water, Saline water, Water purification, Feasibility studies, Costs, Water rates, Capital costs.

The electrodialysis process is evaluated; mathematical relationships predicting the costs of the electrodialysis process to convert selected saline waters to potable water are presented; technical problems leading to the design of electrodialysis plants are reviewed; and areas where additional research and development can reduce the cost of water produced by electrodialysis are identified. A computer program, using Fortran II, was designed to operate on any possible combination of the following variables: six capacities, six waters, two climates, two mean current densities, four labor rates, two product water storage times, two interest rates, and four electrical rates. This program is readily adapted to make use of future developments related to the variables. It is concluded that it is technically feasible to desalinate most natural saline waters with the electrodialysis process; economic feasibility has been proven for brackish water in the 1,000 to 10,000 ppm range; the cost of converting brackish water to potable water ranges from 40 cents to $1.50/1000 gallons, depending on the water analysis and plant capacity; and an economically optimum, practical plant capacity is about 5,000,000 gpd. (Davison-IPA)
W79-05081

THIRD ANNUAL REPORT: SALINE WATER CONVERSION DEMONSTRATION PLANT NO. 1, FREEPORT, TEXAS.
Stearns-Roger Corp., Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-193 120, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 123, September 1964. 174 p, 39 fig, 28 tab, 11 ref, 1 append. 14-01-001-218.

Descriptors: *Desalination plants, *Desalination processes, *Long-Tube vertical distillation, *Desalination, Water purification, Mechanical equipment, Hydraulic machinery, Economics, Capital costs, Operating costs, Cost analysis, Cost comparisons, Evaluation, On-site investigations, Corrosion, Construction materials, Evaporation, Construction, Demonstration Plant No 1, Scaling.

Information concerning the Long-Tube Vertical (LTV) multiple-effect evaporation method of desalination employed by Demonstration Plant No. 1, Freeport, Texas, is presented. The technical, logistical, and economic evaluations for fiscal year 1964 operations are discussed in addition to the process and mechanical development program results as related to the LTV process in particular and desalination in general. Capital and operating costs are compared to theoretical normalized capital and operating costs. Production, economy ratios, cost averages, and maintenance problems are presented. A technical evaluation of the existing process, equipment, corrosion, and construction materials is included. The process evaluation includes limitations to the temperatures and concentration ratios for scale-free operation of LTV evaporators without presoftening the feed water. Each category of process equipment was evaluated. Information concerning the performance of the subsystems emphasizes the deaerator-decarbonator. Plant heat and material balance is illustrated by a flow diagram. (Davison-IPA)
W79-05082

INVESTIGATION AND PREPARATION OF POLYMER FILMS TO IMPROVE THE SEPARATION OF WATER AND SALTS IN SALINE WATER CONVERSION.
Monsanto Research Corp., Everett, MA. Boston Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 467, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 69, December 1962. 71 p, 16 fig, 20 tab, 6 ref, 2 append. 14-01-001-203.

Descriptors: *Membranes, *Polymers, *Desalination, *Membrane processes, Permeability, Films, Thin films, Ion exchange, Laboratory tests, Hydrogen bonding, Water purification, Water treatment, Water quality, Water quality control, Surfactants.

An experimental program to investigate and evaluate cellulose acetate films, and to clarify the basic principles of film performance is reported. Polymeric films of currently available materials were prepared and tested. A cellulose acetate composition containing 10% PEG-200 has a transmission rate of 1.07 g/cm2/hr with more than 90% salt rejection. An increased rate and improved salt rejections resulted from the development of a thermal method of film treatment. Modified polyvinyl alcohol and cellophane films gave improved salt rejection and maintained good transmission rates. The effects of wetting agents and hydrogen bonding on film performance are discussed. Film processing variables on film structure were determined. (Davison-IPA)
W79-05083

UTILIZATION OF ISOTOPES FOR SALINE WATER CONVERSION.
Chance Vought Corp., Dallas, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 469, Price codes: A18 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 68, December 1962. 398 p, 131 fig, 14 tab, 60 ref, 8 append. 14-01-001-210.

Descriptors: *Desalination, *Radioisotopes, *Desalination apparatus, Economic feasibility, Compatibility, Design data, Nuclear energy, Nuclear wastes, Costs, Cost estimates, Saline water, Water purification, Water treatment, Equipment, Laboratory tests, Hazards, Evaluation, Technology, Research and development.

A study involving the use of radioisotope power as a heat source for desalination is presented in three sections. A preliminary analysis of the economic feasibility of radioisotopes for desalination, and a parametric analysis of the economic feasibility of nuclear heat sources are presented in Section I. In Section II the various design parameters and associated compatibility problems were studied, and a conceptual design of a nuclear heater capable of supplying the thermal requirements for a 1,000,000 gpd desalination plant operating at 200 kwh/1000 gallons was developed. The design of a laboratory test model, based on the data of Section II and capable of producing 250 gpd of fresh water from saline water, is presented in Section III. The conversion system of this model was completely designed and analyzed for hazards. It is concluded that the most economic source of energy for this type of power is the calcined fission product waste from processed spent reactor fuel elements. (Davison-IPA)
W79-05084

RESEARCH AND DEVELOPMENT OF PROCESSES FOR DESALTING WATER BY FREEZING,
Washington Univ., Seattle. Engineering Experiment Station.
H. H. Hendrickson, and R. W. Moulton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 385, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 10, August 1956. 172 p, 53 fig, 36 tab, 13 ref, 5 append. 14-01-001-73.

Descriptors: *Desalination, *Desalination processes, *Freezing, *Sea water, Ice-brine systems, Ice-water interfaces, Separation techniques, Centrifugation, Economics, Cost analysis, Cost comparisons, Desalination apparatus, Vapor compression distillation.

Field tests were run with sea water on commercial and industrial icemakers of all available types. These icemakers included can-ice plants, flake-ice

machines, slush-ice machines, tube-ice machines and ice cream freezers. Although saline reduction was obtained, no commercial icemaker reduced the 30,000 ppm total solid content of sea water down to the 500 ppm of potable water. The performance of several representative icemakers were studied in the laboratory under controlled conditions to determine the best methods to separate entrapped salt from ice-brine mixtures. Theoretical studies were made of freezing cycles to find the most efficient one; economic studies were made of the most promising ones. During the testing it was determined that primary function of the freezing is to produce an ice-brine mixture that is readily separable. Auxiliary separating equipment will be required, because a certain amount of salt brine is always entrapped by the pure ice crystals. The separation methods studied were: centrifugation, gravity draining, vacuum draining, and compression. Compression gave the best results below 2000 ppm. Cost analysis were made comparing freezing to a hypothetical multiple-effect vapor compression distillation plant. Costs were $2.31/1000 gallons for freezing and $1.94/1000 gallons for a 12 effect distillation plant. (Davison-IPA)
W79-05085

TEST MANUAL (TENTATIVE) FOR PERMSELECTIVE MEMBRANES.
Bureau of Reclamation, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 575, Price codes: A10 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 77, January 1964. 208 p, 20 fig, 1 tab. 14-01-001-165.

Descriptors: *Permselective membranes, *Cation, *Anion, *Testing procedures, Chemical analysis, Chemical properties, Physical properties, Physicochemical properties, Sampling, Storage, Desalination, Electrodialysis.

A set of specific, standardized test methods covering sampling, storing, and shipping of anionic and cationic permselective membranes is presented. The tests are listed according to the properties to be measured, and they are numbered as follows: 100. methods of inspection and sampling; 200. sample preparation, storage, and shipment; 300. visual test methods; 400. physical test methods; 500. chemical test methods; 600. electromechanical test methods; 1000. reporting results; and 2000. theory and glossary of terms. Individual tests and procedures are indicated by a change in the final digits of the basic category number, and different methods used to determine the same class of properties, or similar methods used to determine the same property with different materials are indicated by digits after the decimal point. Although the tests in this manual are primarily for permselective membranes to be used in the electrodialysis desalination process, it is believed that they can be adapted for other process requirements by changing reagents or other test conditions. (Davison-IPA)
W79-05086

SOLAR DISTILLATION OF SEA WATER IN THE VIRGIN ISLANDS,
G. O. G. Lof.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 380, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 5, February 1955. 41 p, 6 fig, 3 tab, 7 ref, 2 append.

Descriptors: *Desalination, *Solar distillation, *Solar stills, Desalination apparatus, Water purification, Separation techniques, Sea water, Desalination processes, Virgin Islands, Water yield, Water supply, Heated water, Heat balance, Evaporation.

The experimental program using a solar distiller consisting of a 4 x 9 ft horizontal evaporating pan covered with 45 degree sloping glass panels is discussed. Sea water was supplied to the tray to a depth of 1 to 2 inches, and evaporation took place as the sun warmed the black bottom of the pan. Distilled water condensed on the inside of the glass panels and ran down into troughs at the base of the panels. The water was collected and measured hourly during the experimental runs from November 26, 1948 to April 4, 1949. The water temperature in the distiller was measured, the sky condition was noted, and the total water production for each day was computed. Under the average prevailing solar conditions of the Caribbean Islands' winter, the distiller operated at about 35% solar utilization efficiency with a daily yield of about 0.6 lb of water/sq ft of evaporator pan. This yield, about half of the ideal yield for this type of equipment, would be improved by reducing heat losses. Experiments with preheated water showed a substantial increase in yield. It is concluded that distilled water could be produced in the Virgin Islands for about $1.00/thousand gallons if this type of distillation equipment could be built for $1.00/sq ft of pan area and in a government owned plant with a fixed charge of 5%/year. (Davison-IPA)
W79-05087

DEMINERALIZATION OF SALINE WATER WITH SOLAR ENERGY,
G. O. G. Lof.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 379, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 4, August 1954. 84 p, 20 fig, 5 tab, 67 ref. 14-01-001-55.

Descriptors: *Desalination processes, *Solar distillation, *Desalination apparatus, Solar stills, Evaporators, Water treatment, Water purification, Economic feasibility, Costs, Construction costs, Estimated costs, Water rates, Saline water, Demineralization.

Numerous proposed methods for demineralizing saline water with solar energy have been analyzed from the engineering and economic viewpoints, and probable minimum costs for producing fresh water with these methods have been estimated. The two main categories of solar demineralization processes are those using electric energy generated in a solar power plant, and those using heat developed in a solar energy absorber. The major types of solar demineralization are compared with each other and with conventional evaporation methods. Those processes possessing better utilization prospects are further analyzed. Individual investment and operating cost items are tabulated, and approximate total water production costs for a one million gpd plant are determined. The cost of producing water with these methods ranges from $1.00 to $4.00/1000 gallons. A large, publicly owned sea water demineralization plant employing glass covered evaporation pans at an investment cost of $1.00/sq ft of evaporating surface could produce fresh water at approximately $1.60/1000 gallons. It is concluded that only solar evaporation can be economically competitive with the least expensive conventional methods, and that the simple, direct heated solar still is economically superior to other solar demineralization equipment. (Davison-IPA)
W79-05088

FURTHER PROPERTIES OF HYDRATES AND HYDRATING AGENTS.
Syracuse Univ., Research Corp., NY.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 425, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 70, January 1963. 75 p, 11 fig, 15 tab, 8 ref, append. 14-01-001-177.

Descriptors: *Hydrates, *Hydrate processes, *Solubility, *Solubility apparatus, *Crystal growth, Crystallization, Freezing, Demineralization, Desalination, Separation techniques, Supercooling.

Research results on the thermodynamic properties and solubilities in hydrate systems and on the rates of growth of ice crystals are presented. A solubility apparatus was used in experiments to test F-21, F-31, methyl bromide, F-142b, and F-12B1. Results of those solubility tests are summarized in tabular form. Data on chlorine, propane, methyl chloride and F-12 are included. It is concluded that propane is the least soluble of the hydrating agents and F-31 is the most soluble. Preliminary work in the study of the kinetics of hydrate growth has been on ice crystal growth. A summary of previous ice crystal growth work is presented. (Davison-IPA)
W79-05089

SOLIDIFICATION AND SEPARATION OF ICE FROM SALINE WATER,
Massachusetts Inst. of Tech., Cambridge.
C. M. Adams, Jr., and P. K. Rohatgi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 591, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 94, March 1964. 40 p, 22 fig, 4 ref. 14-01-0001-279.

Descriptors: *Desalination, *Freezing, *Ice-water interfaces, *Crystal growth, *Boundaries(Surface), *Ice-brine systems, Magnetic studies, Electric fields, Aqueous solutions, Crystallization, Desalination processes, Separation techniques, Water treatment, Water purification, Ice.

In an investigation of the mechanism of solidification of aqueous solutions, droplets and aqueous solutions on a flat surface were frozen and magnetic and electric fields were externally applied to the frozen samples; microphotography was used to study the dendrite structures and spacings of these samples. It was found that in dilute aqueous solutions generally the crystal line aggregate takes the form of groups of parallel uniformly spaced plates. Plate spacing is dependent on the freezing rate, and varies with concentration and magnetic fields. The individual plates in the dendrite structure are pure ice, and the salt is displaced to regions between the plates. Large areas of brine were observed in irregular masses between neighboring groups of dendrites. Dendrite spacing increases with salt concentration up to the melting-freezing point, and an increase in concentration influences the character of the individual dendritic plates. Stationary magnetic fields increase dendrite spacing for a given freezing rate; an increase in the magnetic field induces serrations and side branching of dendritic plates. It is concluded that under fast freezing conditions, binary and ternary aqueous solutions with a wide range of concentrations produce groups of parallel plate-shaped dendrites, and that magnetic fields are less influential when freezing is initiated from a solid chill surface under gradient freezing conditions than under uniform freezing rates. (Davison-IPA)
W79-05357

ECONOMIC AND TECHNICAL EVALUATION OF THE WIPED FILM EVAPORATOR,
General Electric Co., Burlington, VT.
R. E. Anderson, and C. W. Lotz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 686, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report, No. 105, July 1964. 37 p, 14 fig, 1 tab. 14-01-0001-248.

Descriptors: *Desalination, *Desalination processes, *Desalination plants, *Wiped film evaporator, Pilot plants, Testing, Evaluation, Equipment, Economics, Capital costs, Operating costs, Sea water, Evaporation, Heat transfer, Films, Wrightsville Beach(North Carolina).

Tests conducted on the wiped film evaporator at the pilot plant at Wrightsville Beach Test Station in North Carolina are described. The pilot plant is a double effect type plant employing the double flute evaporation process as well as the wiped film evaporator. Data obtained during the shake-down runs of the entire plant indicated needed improvement for the following wiped film still components: lower shaft bearing, upper shaft bearing, gear box bearings, tube wall, acid line, and condenser shell vent. Six single effect wiped film tests

were run during October 1963 after the recommended modifications had been made. Evaporation temperature ranged from 170 to 210F, temperature differences were 5 and 10 degrees F, while the blowdown concentration factor remained constant. Performance was better at the lower temperature difference because the smaller quantity for sea water feed results in a thinner, less resistant evaporating film. Estimated capital costs for a one mgpd wiped film plant are presented and include equipment and construction costs. Estimated annual operating costs include fuel costs, power costs, chemical costs, maintenance, and labor costs. The cost of product water from a wiped film evaporator is $1.46/1000 gallons. (Davison-IPA)
W79-05358

THERMODYNAMIC PROPERTIES OF SALINE WATER,
Monsanto Research Corp., Everett, MA. Boston Lab.
W. H. Power, and B. M. Fabuss.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 685, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 104, July 1964. 85 p, 22 fig, 8 tab, 24 ref, 1 append. 14-0001-294.

Descriptors: *Desalination, *Calcium sulfate, *Water chemistry, *Thermodynamics, *Physicochemical properties, Hydrates, Anhydrite, Calcium compounds, Gypsum, Laboratory tests, Saline water, Water properties, Water analysis, Solubility.

The solubility of calcium sulfate and its hydrates in pure and saline waters from 25 to 250C were determined to obtain experimental information on the thermodynamic properties of certain components present in saline waters. The preparation and characteristics of the calcium sulfate modifications and its hydrates used in this study are listed for gypsum, selenite (natural), alpha-hemihydrate, beta-hemihydrate, beta soluble anhydrite, insoluble anhydrite, and insoluble anhydrite (natural). The three experimental units, low temperature, intermediate temperature, and high temperature, are described. Solutions, solids and specific conductances of calcium sulfate solutions were analyzed, and the summary of these solubility measurements are tabulated. Vapor pressure measurements and density measurements have not been made, but the equipment with which these measurements will be made is described. It is concluded that data obtained in this study are in good agreement with the data in literature. (Davison-IPA)
W79-05359

HEAT TRANSFER AND CORROSION CHARACTERISTICS OF CAPILLARY FLUTED ALUMINUM TUBES,
AiResearch Mfg. Co. of Arizona, Phoenix.
E. L. Kumm.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 241, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 103, October 1964. 81 p, 39 fig, 3 tab, 18 ref. 14-01-0001-362.

Descriptors: *Desalination, *Desalination processes, *Vapor compression distillation, *Desalination apparatus, *Thin films, *Aluminum, *Aluminum alloys, *Corrosion, Coatings, Cathodic protection, Surfaces, Tubes, Heat transfer, Evaporation, Sea water, Economic justification.

A theoretical and experimental study of techniques to improve thin-film evaporation by using fluted aluminum tubes is presented. A discussion of the vapor compression distillation system for desalination of sea water includes thermodynamic considerations, heat transfer in evaporator condenser tubes, aluminum corrosion, and economic considerations. The many coatings used to improve the resistance of the naturally oxidized surface of aluminum are divided into two classes: (1) chemical conversion treatments including anodizing bath, oxide formation, chromate conversion, and boehmite formation; and (2) film coatings including plastics and metals. They can be used separately or in combination. Immersion tests were made of aluminum alloy samples with various coatings and sea water. The best coating tested consisted of an aluminum alloy covered with a boehmite film. The overall results show that aluminum is very resistant to sea water corrosion when the water is uncontaminated by the heavy metal ions, copper, iron and nickel. A boehmite-coated tube given cathodic protection showed no surface pitting after being subjected to applied voltage equivalent to about 5 microampheres/sq ft of tube surface for 1080 hours. Microscopic examination of fluted tubes revealed salt deposits had occurred on the sharpest edges and in the crevices, except for the tube internally coated with silicone UCAR 101. (Davison-IPA)
W79-05360

INVESTIGATION OF THERMAL DIFFUSION FOR SALINE WATER CONVERSION,
Philco, Newport Beach, CA. Research Labs.
J. L. Richardson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 687, Price codes: A10 in paper copy, A01 in microfiche. OSW Research and Development Report No. 107, July 1964. 217 p, 57 fig, 16 tab, 168 ref, 6 append. 14-01-0001-297.

Descriptors: *Desalination, *Mass transfer, *Diffusion, *Thermal properties, Theoretical analysis, Saline water, Sea water, Physical properties, Mathematical studies, Ion transport.

The mechanism of mass transfer in an ionic solution where temperature and concentration gradient coexist was investigated. Theoretical predictions were made of the ordinary and thermal diffusion properties of sea water and saline water. Mass diffusion properties of these saline systems are very dependent on temperature; their variation with concentration is slight. Results indicate that the thermal and ordinary diffusion coefficients of sea water are smaller than those of the saline water at similar conditions of temperature and concentration. Multi-component effects are considerably important in these systems. Theoretical and experimental evidence indicate that ions diffuse at significantly different rates, and sometimes in opposite directions depending on whether the ion is in a binary or multicomponent ionic solution. Thermogravitational column studies showed that the achievement of appreciable separations of salt from water requires an excessive length of time. Areas requiring further investigation are indicated. (Davison-IPA)
W79-05361

PARAMETRIC COST STUDIES PERTAINING TO DUAL-PURPOSE POWER AND WATER DESALINATION PLANTS,
Burns and Roe, Inc., New York.
L. Stone, F. J. Patti, M. E. Knebel, W. G. Gerber, and M. Zizza.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 694 Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 109. 1964. 111 p, 54 fig, 18 tab, 8 ref, 2 append. 14-01-001-345.

Descriptors: *Desalination plants, *Multistage flash distillation, *Nuclear powerplants, Nuclear reactors, Desalination, Desalination processes, Economics, Electric power costs, Water costs, Potable water, Saline water, Electric power production, Optimization, Steam turbines.

The results of an optimization study conducted on the design and economics of multistage flash evaporation plants which produce both potable water and electric power are reported. Water and power production costs were determined for conversion plants with capacities ranging from 7 to 50 mmgpd in conjunction with electric power generators driven by steam from nuclear reactors of 40, 70, 120, and 500 MWt. Brine heater temperatures of 250F and 350F were considered, municipal financing rates were used, and electric power was considered to be sold at production cost. Optimization was also obtained for fossil-fueled plants in the 1 to 14 mmgpd range. The unit costs for producing desalinated water in dual-purpose nuclear plants decreased as the reactor power levels increased from 40 to 500 MWt, and fresh water production levels were increased from 7 to 20 mmgpd. At the 500 MWt reactor power level there was little change in the unit cost of water for a production range from 20 to 50 mmgpd. Unit capital costs rise as water production is decreased, but savings can be effected for a given water production by increasing the reactor power level. The unit cost of electricity was based on the net generation being equal to the gross generation minus the auxiliary power required for the steam and turbine plant. Because the fossil fueled plants were all single purpose plants, they were not comparable to most nuclear plants. (Davison-IPA)
W79-05362

RESULTS OF SELECTED LABORATORY TESTS OF AN IONICS DEMINERALIZER,
Ionics, Inc., Watertown, MA.
N. W. Rosenberg, T. A. Kirkham, C. E. Tirrell, and N. E. Saliba.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 376, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 1, April 1954. 75 p, 35 fig, 14 tab. 14-01-001-52.

Descriptors: *Desalination, *Desalination processes, *Demineralization, *Water purification, *Costs, *Estimated costs, Membranes, Membrane processes, Evaluation, Cost analysis, Ion exchange, Desalination apparatus, Laboratory tests, Equipment, Brackish water, Sea water, Electric currents, Electric power demand, Resistance.

An investigation of the process variables of an Ionics membrane demineralizer, an electrical process, as applied to brackish waters from South Dakota, Arizona, and Texas, and sea water and diluted sea water is discussed. Emphasis was directed toward developing an optimum operation technique for minimizing the cost of demineralizing water with this process. The theoretical basis of membrane demineralization and the operation of the experimental unit are discussed. Results of the laboratory operation include information on operating data, voltage-current relations, resistance vs purification, current vs purification, power demand vs product concentration, product concentration vs flow rate, power index vs feed concentration, variation in waste stream flow, hydraulic pressure drop, performance on field samples, electrode efficiencies, ppm reduction, and product water yield. Cost estimates to treat each of the three brackish waters were prepared based on a facility designed to produce 3,280,000 gph with a water quality of 6 epm. The estimates included an estimation of auxiliary equipment required. It is concluded that this process shows sufficient potential to warrant field operation of a larger installation to confirm the estimates of this study. (Davison-IPA)
W79-05363

DEVELOPMENT OF A DIRECT-FREEZING CONTINUOUS WASH-SEPARATION PROCESS FOR SALINE WATER CONVERSION,
C. M. Bosworth, S. S. Carfango, and D. J. Sandell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 397, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 23, January 1959. 80 p, 30 fig, 16 tab, 1 append. 14-01-001-86.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Freezing, Ice, Ice-brine systems, Equipment, Costs, Cost analysis, Cost comparisons, Economic feasibility, Electric power costs, Operating costs.

The first phase of research evaluating a direct freezer and a counter-current washing separation column is discussed. Ice was produced at a very low temperature using a direct freezer. The temperature difference is one to two degrees F. It was

found that separation of ice using a counter-current washing column is feasible. Only 5% of the product was wasted as wash water, when the ice produced contained less than 500 ppm salt concentration. Estimates were made of the cost of the process using a compressor for vapor removal and an absorption machine, and a comparison was made with a conventional refrigerating process. An analysis indicates that the process is economically feasible with power costs ranging from $.13 to $.50/1000 gallons; other operating costs are $.15 to $.30, and amortization on a 100,000 gpd plant varies from $.50 to $1.00. The equipment, experimental work, and results are illustrated with photographs, charts, and tables. (Davison-IPA)
W79-05364

DEMINERALIZATION OF SALINE WATER BY ELECTRICALLY-INDUCED ADSORPTION ON POROUS CARBON ELECTRODES,
Oklahoma Univ., Norman. Dept. of Chemistry. 14-01-001-160.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 142, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 58, March 1962. 85 p, 12 fig, 11 tab, 15 ref, 1 append. 14-01-001-160.

Descriptors: *Desalination, *Desalination processes, *Demineralization, Anion exchange, Cation exchange, Electrodes, Electrodialysis, Electrochemistry, Separation techniques, Desalination apparatus, Estimated costs, Cost analysis, Carbon.

The development, fabrication, and characterization of carbon electrode cells for use in saline water demineralization are reported, and cost estimates for a 100,000 gpd brackish water plant utilizing this electrochemical method are presented. During the past year carbon blacks and chars have been incorporated into demineralization electrodes, and higher capacities have been attained for cation-responsive and anion-responsive electrodes. Electrode backing material, changed from Dacron felt to Dacron 'paper', has resulted in more beneficial electrode characteristics. Two new cells were constructed: the DC-5, a multi-electrode high-capacity cell, and the DC-6, a small versatile cell designed for electrode development. A new approach in cell design was used for the preparation of composite cation-and anion-responsive electrodes which were tested. The laboratory demineralization apparatus was expanded, so that simultaneous operation of two demineralization cells became possible, and the testing process was accelerated. The results of the cost estimates for demineralizing brackish water with carbon electrodes indicate that the process is economically competitive with other currently in use. (Davison-IPA)
W79-05365

ABSORPTION-MULTISTAGE FLASH DISTILLATION PROCESS,
Fluor-Singmaster and Breyer, Inc., New York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 545, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 81, September 1963. 77 p, 24 fig, 7 tab, 37 ref, 4 append. 14-01-0001-305.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, *Sherwood absorption-distillation process, Flash distillation, Cost estimates, Capital costs, Operating costs, Evaporation, Water treatment, Water purification Water rates.

The application of the Sherwood Absorption-Distillation Process, or absorption solution cycle, to multistage flash evaporation is reported. The four objectives of this work include: (1) a literature study; (2) selection of absorbent for the solution cycle; (3) preparation of a process flow sheet with temperature pressure, and material and energy balance; and (4) capital and operating cost estimates for a 10 mgpd plant. The process is described and the development of the absorption cycle in combination with multistage flash distillation is discussed. A summary of performance and design data based on flow sheets is presented. The plant design provides for four absorption-multistage flash evaporator units, each with a 2,500,000 gpd capacity requiring steam supplied by two 600 psig, 600F boilers; steam turbines are included in the design. Capital cost expenditure is $1.29/daily gallon and water production cost is $.68/1000 gallons of distilled water. It is concluded that the development study of this process confirms that a high thermal efficiency and economy can be realized by generating high pressure steam to produce the power needed for pumping and other operations in the distillation plant. Comparative costs favor the absorption-multistage flash evaporator plant when fuel costs exceed $.25/million Btu; the two processes are equal when fuel costs are $.35 to $.40/million Btu. (Davison-IPA)
W79-05366

INVESTIGATION OF THE AVAILABILITY OF GEOTHERMAL ENERGY FOR THE DEMINERALIZATION OF SALINE WATER,
School of Mines Research and Development Association, Rapid City, SD.
J. R. MacDonald, E. R. Stensaas, P. M. Stafford, and J. R. Cope.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 401, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 28, July 1959. 48 p, 11 fig, 4 tab, 9 ref, 1 append. 14-01-001-87.

Descriptors: *Desalination, *Desalination processes, *Geothermal studies, *Thermal properties, Thermal springs, Geysers, Geologic investigations, Geological surveys, Black Hills(South Dakota), California, Analog models, Demineralization, Evaporators, Water purification.

Part I examined the availability of geothermal energy from the Black Hills of South Dakota. Since the geology and structure of this area are well known, and the area is known to have many hot wells, it was thought that a study of the region would provide conclusions which could be applied to other areas in relation to geothermal energy. Heat extraction from a geologic structure similar to the Black Hills was studied with an electric analog method; conclusions were applied to known well data. The data indicates that the thermal gradients of the region are not much higher than the average thermal gradient reported for the earth's crust and, therefore, the Black Hills do not offer any advantage for extraction of geothermal energy. Part II presents an investigation of the availability of geothermal energy in California and its applicability to demineralization of saline water. The two aspects of the investigation included the extraction of heat from a thermal well and the extraction of heat from a hydrothermal source, such as hot springs, geysers, and steam wells. Using an assumed design of a two-stage multiple-effect evaporator plant and a long vertical-hole heat collection surface, the cost of 1,000 gallons of fresh water produced using a thermal well as an energy source was $13.50. Steam wells offer the nearest approach to a thermal energy source for the demineralization of saline water. Insufficient data on steam well output makes it difficult to estimate the potential of these sources. (Davison-IPA)
W79-05367

THE KOPPERS HYDRATE PROCESS FOR SALINE WATER CONVERSION EXPERIMENTAL AND ENGINEERING STUDIES,
Koppers Co. Inc., Pittsburgh, PA.
E. D. Brennan, and P. Van Der Heem.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 397, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 125, 1964. 39 p, 14 fig. 14-01-0001-365.

Descriptors: *Desalination processes, *Koppers Hydrate Process, *Hydrate processes, *Crystal growth, *Hydration, Separation techniques, Crystallization, Filters, Chlorine, Desalination, Desalination apparatus, Water purification, Water treatment.

Hydrate crystallization studies, filter cloth evaluations, and preliminary studies for the development of a filter-washer with a continuously moving hydrate bed are presented in the continuing research on The Koppers Hydrate Process. The technique developed to grow larger hydrate particles involved the introduction of the liquid agent into the reactor at pressures below the vapor pressure line. In large-scale washing experiments filter cloth flow resistance was demonstrated. Periodic back washing of filter cloths to remove particles larger than five keeps the flow resistance at acceptable levels. Polypropylene cloth is a more suitable filter cloth than nylon because nylon stretches. A bench-scale filter-washer was used to demonstrate the feasibility to continously form and move hydrate cakes of equal densities to those attained in fixed-bed filters. The moving cakes were counter-currently washed efficiently across reasonable cake depths of one foot or less. Orientational studies of chlorine hydrate and mixed hydrates were made. Chlorine hydrate is easily prepared as a coarse, crystalline precipitate, but its feasibility in this process depends on the possibility of removing bromine as a byproduct. Mixed hydrates can be considered, because they are based on non-poisonous materials. (Davison-IPA)
W79-05368

PRELIMINARY DESIGN STUDY OF AN OPTIMUM NUCLEAR REACTOR-SALINE WATER EVAPORATOR PROCESS,
Fluor Corp. Ltd., Whittier, CA. Research Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 010, Price codes: A12 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 34, 1959. 233 p, 33 fig, 28 tab, 55 ref, 12 append. 14-01-001-161.

Descriptors: *Desalination, *Desalination processes, *Desalination plants, *Flash distillation, *Nuclear reactors, *Costs, Estimated costs, Construction materials, Capital costs, Operating costs, Design criteria, Optimization, Research and development.

An engineering design study of a light water-moderated and cooled nuclear steam generator with a multistage flash distillation system for the production of potable water from sea water is examined. The capital cost estimates, construction materials, design conditions, process description, and water costs are presented for a 50 mgpd conversion plant and a one mgpd conversion plant. The process condition variation for the 50 mgpd plant, and experimental flexibility for the one mgpd plant are discussed. The pressurized water reactor (PWR) used to supply the steam for the 50 mgpd conversion plant is described in terms of plant design and selection of materials. Fuel cycle costs and operating costs are discussed. The estimated cost of potable water produced from sea water in a 50 mgpd 52 stage flash evaporator with steam supplied by a nuclear reactor is $.42/1000 gallons. This estimated cost includes all costs associated with the plant operation. The direct field cost of the plant is equivalent to $.73/gallon/day; total plant cost is equivalent to $.86/gallon/day; and steam cost is estimated at $.37/million Btu. It is concluded that the cost of converting sea water into potable water using this technology is low enough to make it potentially important in augmenting the water supply for many areas of the world. (Davison-IPA).
W79-05369

DEVELOPMENT OF THE SOLVENT DEMINERALIZATION OF SALINE WATER,
Texas A and M Research Foundation, College Station.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 769, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 35, February 1960. 92 p, 23 fig, 6 tab. 14-01-001-77, 14-01-001-106.

Descriptors: *Desalination processes, *Desalination, *Desalination apparatus, *Solvent extraction process, Solvent extractions, Solvents, Solubility, Heterogeneity, Equilibrium, Physical properties, Brackish water, Cost analysis, Sea water, Ethers, Sodium chloride.

Continued research on the solvent extraction process for desalination of sea water is reported. Physical data on a number of solvents is presented. Fundamental consideration was given to primary, secondary, and tertiary amines, and the glycerol and glycol ethers. Solubility in water, density, retractive index, and boiling point are listed, followed by heterogeneous equilibrium data for some of the compounds with water and sodium chloride. The laboratory model of the extraction process was operated to improve the process, and to determine the effect of process variables, including increasing the concentration of waste brine. The results of the operational data were as predicted from the equilibrium and solubility data for the solvents used. Cost equations, based on a 10 mgpd plant, were developed for two solvents under various conditions. It is recommended that the solvent extraction process be studied on a small plant scale using di-isopropylamine as the solvent. It is concluded that this process has certain advantages over other processes being considered for desalination of brackish water with a salt content of 5,000 to 10,000 ppm. (Davison-IPA)
W79-05370

WEATHERING TESTS OF PLASTICS AND DESIGN OF SUSPENDED ENVELOPE SOLAR STILLS,
Bjorksten Research Lab., Inc., Madison, WI.
OSW Research and Development Progress Report No. 30, September 1959. 45 p, 14 fig, 7 tab, 3 ref. 14-01-001-91.

Descriptors: *Desalination, *Desalination apparatus, *Solar stills, *Solar distillation, *Plastics, *Weathering, Exposure, Distillation, Deterioration, Fabrication, Films, Laboratory tests.

An investigation of the resistance of plastic film materials to solar radiation and weathering caused by distillation conditions was carried out with laboratory tests and outdoor exposure tests. Sample containers were developed to protect the specimens of film while they were exposed to distillation conditions. An accelerated testing device was constructed which seemed suitable for rapid screening materials, but direct correlation with outdoor exposure was not established. The testing program was expanded to include preliminary design, construction and testing suspended envelope stills in a modular unit form. The design developed uses commercially available structural elements which require a minimum amount of fabrication into still modules. The available plastic materials with superior resistance to exposure presented problems in effective sealing. Fluorocarbon plastic films were superior in resisting solar distillation conditions, but their high cost and limited availability make it impractical to use them for solar stills. It was found that adhesives or other plastics in contact with the film must be selected for compatibility with it under distillation conditions of solar exposure and humidity. It is concluded that in regions suited for year-round operation of solar stills, the optimum inclination angle for suspended envelope stills tend to equalize the production of product water throughout the year because collection efficiency is increased at low sun angles. (Davison-IPA)
W79-05371

3C. Use Of Water Of Impaired Quality

ABSOLUTE SOLUTION TO INDUSTRIAL WASTE WATER PROBLEM--OUTFALL PREVENTION (DIE ABSOLUTE LOESUNG DES INDUSTRIEABWASSER--PROBLEMS -- UNTERBINDUNG DES ABFLUSSES),
For primary bibliographic entry see Field 3E.
W79-05433

CONTROLLING IRON OXIDE DEPOSITION IN BOILER SYSTEMS,
Nalco Chemical Co., Chicago, IL.
J. A. Kelly, and T. R. Filipowski.
TAPPI Engineering Conference, San Francisco, CA., September 19-21, 1978, Preprinted Proceedings (TAPPI, Atlanta, GA), p 467-481. 13 fig, 13 illus, 8 ref, 6 tab.

Descriptors: *Boiler feed water, *Iron oxides, *Water treatment, *Corrosion, Industrial water, Pulp wastes, Pulp and paper industry, Effluents, Dissolved oxygen, Deaeration, Iron compounds, Dispersion, Water softening, Demineralization, Boilers, Amines, Condensates, Oxides, Water properties.

The use of high-Btu condensates from the paper machine and other mill areas as feedwater to the power boiler contributes to iron oxide deposition on heat-transfer surfaces. The first approach to combat this problem is to control iron oxide at its source by inhibiting the generation of corrosion products in the condensate system. Chemical control can be accomplished using neutralizing amines for condensate pH elevation and filming for surface protection. Dissolved oxygen, a major corrosion agent, is primarily controlled by mechanical deaeration and residual chemical oxygen scavengers. The second approach is to remove particulate iron oxide from the system by incorporating a condensate polisher to act as a filter. Particulate iron oxide can also be removed from the system after identifying the condensate sources of high iron oxide levels and discontinuing their entry into the boiler feedwater system. The third approach is to chemically control iron oxide deposition in the boiler by using a dispersant, coupled with hardness control agents, to limit particle size growth and inhibit agglomeration. The best results are obtained with a dispersant that interacts with iron oxide in the feedwater and conditions it so that iron oxide transport through the boiler is accomplished. (Swichtenberg-IPC)
W79-05498

3E. Conservation In Industry

PROCESS FOR PHOSPHATE CONVERSION COATING WITH TREATMENT OF RINSE WATER BY REVERSE OSMOSIS AND ION EXCHANGE,
Nippon Paint Co. Ltd., Osaka (Japan). (Assignee).
For primary bibliographic entry see Field 5D.
W79-05372

WHITE WATER RECYCLED AT C.I.P. (CANADIAN INTERNATIONAL PAPER CO.), DALHOUSIE, N.B.,
International Paper Co., Dalhousie (New Brunswick).
E. Mercier.
Canadian Pulp and Paper Association Technical Section, Environment Improvement Conference, October 17-19, 1978, Thunder Bay, Ontario, Preprints, p E1-E3. 3 fig, 1 ref. Canadian Pulp and Paper Association, Montreal.

Descriptors: *Water conservation, *Pulp and paper industry, *Recycling, *White water(Paper machines), Foreign countries, Canada, Water pollution sources, Pulp wastes, Water reuse, Water pollution control, Closed system, Newsprint mills, Groundwood mills, Sulfite pulp mills, Industrial water.

The white water recycling system at the newsprint mill of Canadian International Paper Co. (New Brunswick), in conjunction with the groundwood and sulfite mills, is practically closed, only the second-stage cleaner rejects being sewered. A unique feature is that excess groundwood white water overflows into the sulfite mill white water chest. About 98% of the mixed stock leaves the fourdrinier machines as newsprint or is recycled. The main sources of fiber loss are the paper mill and sulfite mill cleaner rejects as well as come groundwood screen rejects. (Swichtenberg-IPC)
W79-05421

EFFECT OF PROCESS WATER RECYCLE ON POLLUTION CONTROL AND ENERGY CONSERVATION,
Consolidated-Bathurst Ltd., Montreal (Quebec).
Y. M. Mehta.
Canadian Pulp and Paper Association Technical Section, Environment Improvement Conference, October 17-19, 1978, Thunder Bay, Ontario, Preprints, p. D1-D12. 1 append, 13 fig, 6 ref, 6 tab. Canadian Pulp and Paper Association, Montreal.

Descriptors: *Water pollution control, *Pulp and paper industry, *Energy, *Conservation, *Waste water treatment, *Recycling, Pulp wastes, Effluents, Water pollution sources, Water pollution treatment, Foreign countries, Canada, Heat exchangers, Recirculated water, Centrifugation, Industrial water, Instrumentation, Electronic equipment, Particle size, Wastes, Industrial wastes, Newsprint mills, White water(Paper machines).

Pilot-plant and full-scale trials at the newsprint mills of Consolidated-Bathurst Ltd. (Canada) were conducted to evaluate the performance of the Sweco centrifugal screen concentrator. Solids were removed from saveall and pulp thickener filtrates and from pulp machine white water by this cleaning device at an efficiency of 40-60%. Clarified white water is suitable for reuse as shower water and sealing water for vacuum pumps. The Coulter Counter, an electronic device for fine particle size analysis, is used to evaluate the performance of filtration equipment. Heat recovery processes for groundwood effluent streams having suspended solids concentrations up to 2,000 ppm are demonstrated using plate and spiral heat exchangers. (Swichtenberg-IPC)
W79-05422

THE IMPACT OF OXYGEN DELIGNIFICATION SYSTEM ON SCREEN ROOM AND BLEACH PLANT EFFLUENTS,
Eddy Forest Products Ltd., Espanola (Ontario).
C. R. Cook, and J. H. Lund.
Canadian Pulp and Paper Association Technical Section, Environment Improvement Conference, October 17-19, 1978, Thunder Bay, Ontario, Preprints, p. C1-C7. 6 fig, Canadian Pulp and Paper Association, Montreal.

Descriptors: *Bleaching wastes, *Pulp and paper industry, Wastes, Industrial wastes, Pulp wastes, Water pollution sources, Biochemical oxygen demand, Chemical oxygen demand, Effluents, Hydrogen ion concentration, Water consumption(Except consumptive use), Water conservation, Recycling, Water reuse, Dissolved solids, Oxygen, Oxygen bleaching, Delignification, Kraft mills.

An environmental evaluation is presented of the BOD and COD contents of screen room and bleach plant effluents at the bleached kraft mill of E.B. Eddy Forest Products Ltd. (Ontario). Improvements in pH, dissolved solids losses, and water consumption are noted following the conversion of the CEHD bleach line to an OC/DEHD sequence. Oxygen bleaching was introduced, and the conventional chlorination stage was replaced by a high-temperature C/D stage. The total BOD of the screen room and bleach plant effluents was decreased by 50% and the COD by 30%. Oxygen bleaching reduced water consumption by 400 gal/min in the screen room. The sewered flow from the chlorination stage was reduced from 5,000 gal/min for the old chlorination stage to 1500 gal/min after the installation of a titanium washer which recycles most of the chlorination filtrate. (Swichtenberg-IPC)
W79-05423

HIGHLY EFFECTIVE PAPER-MACHINE SHOWER SYSTEMS (VYSOKO-EFFEKTINYE SPRYSKOVYE SISTEMY),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
V. G. Ignatenko, and Ya V. Nikitin.
Bumazhnaya Promyshlennost', No. 8, p 20-21, August, 1978. 1 tab.

Descriptors: *Water conservation, *Pulp and paper industry, *Showers, *Paper machines, Freshwater, Nozzles, Water pressure, Foreign countries, Water reuse, Recycling, Industrial water, Water pollution control, Water pollution sources, Jets, Wastes, Industrial wastes, Soviet Union(USSR), White water(Paper machines), Wash water.

The efficiency of paper-machine wire showers, in terms of wire cleaning quality and fresh water consumption per meter of wire width, is determined by many factors such as the shape of the nozzle jet, pressure, time of action (continuous or intermittent), and the type of paper manufactured. Efficient shower systems installed at several Soviet paper mills are described. For example, the shower system installed on a newsprint machine at the Kondopoga mill combines low-pressure flat (fan-shaped) jet showers operating continuously and utilizing recycled water, with oscillating high-pressure showers operating intermittently and using fresh water. A comparison of various shower systems operating on paper and board machines indicates that the best means to reduce the consumption of fresh water and to prolong the service life of the machine clothing is to combine low-pressure showers with oscillating high-pressure showers, to use nozzles with fan-shaped jets, and to utilize partially recycle water, such as clarified white water. (Stapinski-IPC)
W79-05430

ABSOLUTE SOLUTION TO INDUSTRIAL WASTE WATER PROBLEM--OUTFALL PREVENTION (DIE ABSOLUTE LOESUNG DES INDUSTRIEABWASSER--PROBLEMS -- UNTERBINDUNG DES ABFLUSSES),
A. Bruhne.
Industrieabwaesser, p 9-19, June, 1977. 3 fig.

Descriptors: *Pulp and paper industry, *Water conservation, *Water pollution control, Effluents, Water reuse, Recycling, Waste water(Pollution), Waste water treatment, Evaporation, Corrosion, Foaming, Slime, Waste treatment, Economics, Administration, Legal aspects, Waste treatment, Water pollution sources, Pulp wastes, Wastes, Closed systems, Waste paper, Fine papers, Bactericides, Chlorine, White water(Paper machines), Pollution abatement.

Liquid industrial effluents can be prevented entirely by selecting a dry production technology in lieu of a wet process, e.g., air-laid in lieu of water-laid sheet formation (papermaking) or compressed air in lieu of water as a cooling medium. Volumes of discharge effluents (outfall sewers) can be reduced by recycling of process water and concentration of waste water streams by evaporation, etc., with appropriate process modifications to minimize corrosion, foam, slime, and other operating problems. Examples of closed or partly closed water circuits are illustrated, including a paper mill utilizing waste paper. Limitations of this approach are also pointed out, such as the incompatibility of contaminant accumulations (in recycled water) with high quality specifications for fine papers, the need for increased conditioning and clearing of paper-machine felts and wires, the required addition of bactericidal chlorine compounds with attendant intensified corrosivity of the white water, and quality of makeup (stock-dilution, shower, and evaporation-loss) water. Methods of effluent treatment to chose from, as well as legal, administrative, and economic considerations in water pollution control are also discussed. (Brown-IPC)
W79-05433

BLEACH PLANT OPERATION,
Erco Envirotech Ltd., London (England).
G. Rowlandson, D. W. Reeve, and W. H. Rapson.
U.S. Patent No. 4,104,114. August 1, 1978. 10 p, 16 claims. 3 fig.

Descriptors: *Patents, *Pulp and paper industry, *Bleach plants, *Water conservation, Bleaching wastes, Pulp wastes, Energy, Chemicals, Equipment, Design, Flow, Water, Operation and maintenance, Effluents, Water pollution sources, Water pollution control, Industrial water, Pollution abatement.

A pulp mill bleach plant including a D/CEDED sequence with a washing step after each stage is operated to provide low effluent volume and a low consumption of water, energy, and chemicals, while providing efficient bleaching, caustic extraction, and washing. Water conservation is practiced by controlling the use of wash water in the bleach plant, controlling the design and operation of washers, deckers, and other mechanical devices used in the bleach plant, and controlling the inflow of water with chemicals. The bleach plant produces two liquid effluents, one acid and one alkaline, and these are passed to a recovery operation. (Lynch-IPC)
W79-05497

3F. Conservation In Agriculture

MOVEMENT OF PESTICIDES AND NUTRIENTS WITH WATER AND SEDIMENT AS AFFECTED BY TILLAGE PRACTICES: A FIELD STUDY,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W79-05050

TRICKLE IRRIGATION TUBING HYDRAULICS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 8B.
W79-05061

SIMULATED FLOW RATE REQUIREMENTS FOR SOME FLUSHING EMITTERS,
Rain Bird Technical Services, Logan, UT.
For primary bibliographic entry see Field 8B.
W79-05062

INFLUENCE OF ROW SPACING OF GRAIN SORGHUM ON GROUND COVER, RUNOFF, AND EROSION,
Science and Education Administration, Temple, TX. Grassland, Soil and Water Research Lab.
J. E. Adams, C. W. Richardson, and E. Burnett.
Soil Science Society of America Journal, Vol. 42, No. 6, p 959-962, November-December 1978. 4 fig, 2 tab, 9 ref.

Descriptors: *Grain sorghum, *Vegetation effects, *Runoff, *Erosion, Farm management, Crops, Sorghum, Canopy, Vegetation, Rainfall, Soil erosion, Light penetration, Agriculture. *Row spacing, Plant canopy, Ground cover, Row spacing effects.

A study was begun at Temple, Texas, in 1972 to assess the effect of narrow and conventional row spacing of grain sorghum on runoff and erosion from field-sized areas. Sorghum in narrow rows established a more complete plant canopy earlier than sorghum with conventional row spacing and provided more ground cover for much of the growing season. In 1973, runoff was 45% less and soil loss was 39% less from narrow-row grain sorghum than from sorghum with conventional row spacing. Narrow-row spacing of sorghum increased ground cover significantly (5% level) 35 days after emergence in 1974. Canopy cover was at maximum by 63 days after seedling emergence and provided a ground cover of 46 and 81% for sorghum with 100- and 50-cm row spacing, respectively. (Sims-ISWS).
W79-05258

WATER PRODUCTION FUNCTIONS FOR IRRIGATED AGRICULTURE,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agricultural Economics.
R. W. Hexem, and E. O. Heady.
Iowa State University Press, Ames, Iowa, 1978. 215 p, 72 fig, 2 tab, 68 ref.

Descriptors: *Irrigation, *Agriculture, *Crops, *Production functions, *Western U.S., Estimating, Irrigation efficiency, Irrigation water, Water management(Applied), Soils, Regional analysis, Fertilizers, Climate, Water allocation(Policy), Mathematical models, Equations, Systems analysis, Optimization, Water demand, Linear programming, Simulation analysis, Water supply, Economics, Planning, Profit maximization, Data, Yield response.

Based on a fairly large number of controlled experiments in the western United States, this book deals with the estimation and application of water production functions. The interest is in more efficient use of water for irrigation and in the need to generalize knowledge of water production in terms of crop yields that could be related to different soils and regions in states relevant to the Bureau of Reclamation's program. Generalized productions were sought to estimate the best farm organization and water use, the yield increases expected, and the relevant charges or repayment schedule to associate with each farm receiving water from an irrigation project. Yield response to water is estimated only in interaction with fertilizer applications. Quantified are environmental variables representing climate and soils, which are incorporated into the estimated production functions. Individual chapters deal with: (1) the role of response functions in management and decisions on water use; (2) production functions and economic applications; (3) features of selected production functions; (4) procedures for estimating production functions; (5) origin and features of the research project; (6) analysis of corn, wheat, and cotton experiments; (7) single product and canonical joint product functions for sugar beets; (8) generalized production functions; (9) derived demand functions for water; (10) product supply functions; and (11) programmed water demands. (Bell-Graf--Cornell)
W79-05275

A SOLAR-POWERED PUMP FOR IRRIGATION,
Battelle Columbus Labs., OH.
G. H. Alexander.
In: Proceedings, Irrigation Association 1978 Technical Conference, Cincinnati, February 26-28, 1978. Irrigation Assoc., Silver Spring, MD., 1978, p 1-19. 8 fig.

Descriptors: *Pumps, Pumping plants, *Irrigation.

A solar-powered irrigation pump designed for the Northwestern Mutual Life Insurance Company has been in experimental and developmental operation at Paloma Ranch near Gila Bend, Arizona, since April 1977. An objective of this program was to design and construct a prototype 35- to 50-horsepower solar-energy pumping system to evaluate its applicability in a working irrigation environment. The range includes approximately 22,000 irrigated acres; the yearly energy bill for pumping water is approximately $1.5 million. (Skogerboe-Colorado State)
W79-05287

ENERGY AND IRRIGATION,
Shell Chemical Co., Houston, TX.
J. S. Ostermeyer.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. p. 20-27, 1978.

Descriptors: Energy, *Irrigation, Irrigated agriculture, Irrigation practices, Fertilizers, Nuclear energy.

This paper reviews the energy situation in the United States and how the energy shortage is going to affect the national economy, thereby, the irrigated agriculture. It also suggests the directions of a sound national energy policy to deal with the situation and recommends better farm management practices to reduce the cost of energy in irrigated agriculture. (Skogerboe-Colorado State)
W79-05288

SOLID STATE CONTROL SYSTEMS FOR IRRIGATION,
Solar Wind Systems, Inc., San Rafael, CA.
M. B. Marian.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. p. 35-37, 1978.

Descriptors: Irrigation programs, *Irrigation scheduling, Control systems, *Automatic control, Computer programs.

This paper discusses the basic principles of solid state control systems, causes of failure or malfunction of the systems, customer's responsibilities to insure proper functioning, and their applicabilities in irrigation scheduling. Further, it discusses three basic ways to program an irrigation controller and recommends the use of removable media such as programming with a mark sense card. (Skogerboe-Colorado State)
W79-05289

ELECTRICAL LOAD AND WATER MANAGEMENT,
Science and Education Administration, Fort Collins, CD.
D. F. Heermann, and H. R. Duke.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. 1978. p 60-67, 4 fig, 9 ref.

Descriptors: Load distribution, *Electric power demand, Peak loads, *Sprinkler irrigation.

The objective is first, to review the presently used techniques for reducing peak demands on electrical systems, second, to examine a technique for improving the water management of center pivot sprinkler systems and, third, to explore the integration of load management and water management. An analysis of these aspects led to the conclusion that an integrated load and water management control system offers significant cost savings to today's irrigator. (Skogerboe-Colorado State)
W79-05290

CENTER PIVOTS ON SOILS MARGINALLY SUITED FOR IRRIGATION IN MANITOBA, CANADA,
Manitoba Univ., Winnipeg. Dept. of Agricultural Engineering.
F. F. Penkava.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, OH., February 26-28, 1978. Irrigation Assoc., Silver Spring, MD. 1978. p 68-75, 3 fig 7 ref.

Descriptors: *Sprinkler irrigation, Irrigation effects, Soil classification, Crop production, Soil erosion, Runoff, Potatoes.

The Almasippi series soils of Manitoba have poor moisture holding capacity and high groundwater tables. In spite of those very serious disadvantages irrigated potato production will likely expand on the Almasippi soils. In order to acquire more knowledge on the proper use of center pivot irrigation and on the possible problems and measures for their elimination, a research project was initiated in the spring of 1977 on two localities on which center pivot units were just being installed. The following preliminary conclusions were made based on the research findings: (1) Center pivots, or any other irrigation systems used on the Almasippi series soils in Manitoba must be carefully designed and operated; (2) Single applications should not exceed 20 mm; (3) Application intensities must be carefully balanced with infiltration capacities of the soils and no credit must be given to surface water detention; (4) In carbonated areas application intensity should not exceed 5 mm per hour (0.2 inch/hr); (5) Oversized center pivot units with high precipitation intensities near the end tower should not be used; (6) Random subsurface drainage should be used to control the groundwater levels in the depressions; and (7) Research should continue under real irrigation conditions. (Skogerboe-Colorado State)
W79-05291

ECONOMICS OF IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
L. F. Sheffield.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, MD. 1978. p. 76-90, 5 fig, 7 tab.

Descriptors: *Sprinkler irrigation, *Economic impact, Irrigation, Irrigated land, Cost analysis, Corn belt, Great Plains.

This paper reviews and discusses the accelerated growth of irrigated agriculture with center pivot irrigation systems in the Great Plains Region in the 1970's, and the reasons behind the severity and widespread effects of the current cost-price squeeze on farmers and agri-business community. A detailed analysis of the economics of irrigation leads to the conclusion that irrigated agriculture and the irrigation industry in the United States face a bright future despite its present temporary problems. (Skogerboe-Colorado State)
W79-05292

APPLICATION OF END GUNS ON CENTER PIVOTS,
Nelson Irrigation Corp., Grand Island, NE.
R. E. Hanson.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, MD. 1978. p 91-103.

Descriptors: *Sprinkler irrigation, Uniformity coefficient, Distribution patterns, Application equipment, Crop production.

The main factors probably considered by the pivot irrigator in selecting the use of end guns are the favorable cost per acre and obtaining the maximum corner coverage. Use of end guns in combination with corner covering type systems, end gun sizes in combination and larger end guns have been more recent adaptations on center pivots to extend the corner coverage. Many factors affect the corner coverage obtainable with an end gun. Some of these factors can only be determined through a complete system design for the conditions. Selection of the end gun for the system conditions are based primarily on the gun performance, arc setting, pressure, trajectory angle and nozzle size. Proper application of end guns generally involves the same field, soil, crop, climatic and water supply conditions that must be considered in center pivot application. In addition to obtaining maximum effective corner coverage, other considerations are uniformity of application, droplet impact conditions and application rate. The factors affecting these considerations in the use of end guns on center pivot systems are discussed. (Skogerboe-Colorado)
W79-05293

LIMITS OF LOW PRESSURE SPRINKLERS AND SPRAY NOZZLES ON CENTER PIVOT APPLICATIONS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
J. R. Gilley.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, MD. 1978. p 104-115.

Descriptors: *Sprinkler irrigation, Limiting factors, Nozzles, Application equipment, Uniformity coefficient, Pressure head, Irrigation efficiency, Runoff, Soil erosion.

Low pressure center pivot irrigation systems offer the potential of applying irrigation water with significant energy savings. However, lowering the pressure of center pivot systems may create potential problems of runoff and soil erosion, uniformity of water application and operation. The future use of low pressure systems is dependent upon the solutions to these problems. In some cases low pressure systems should not be used. This paper presents an analysis and discussion of the effects of lower pressures on center pivot applications. (Skogerboe-Colorado State)
W79-05294

SCHEDULING OF WATER AND NITROGEN FOR CORN IN THE HUMID MIDWEST,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Science.
M. L. Vitosh.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, MD. 1978, p 116-123. 1 fig, 4 tab, 11 ref.

Descriptors: *Scheduling, Irrigation, Sweet corn, Nitrogen, Fertilization, Humid climates, Michigan, *Irrigation practice.

This study was conducted in Michigan on irrigated sandy soils where irrigation of corn is a relatively new practice compared to the semi-arid regions. It was recommended that application rate should not exceed 30% of the water holding capacity in the effective rooting zone since the optimum soil moisture level for corn is usually between 50 and 80% of the available water holding capacity. This will prevent or minimize the leaching of nitrate-nitrogen from the rooting zone in the event of rain. Adequate moisture must be available at the end of the growing season to carry the crop to maturity. Further, it was recommended to apply approximately (a) one-third of the total N requirement for the crop as a preplant incorporated or pre-emergence with a herbicide; (b) one-third sidedress or pre-emergence if the first third was applied preplant; and (c) one-third through the irrigation system which should be applied prior to pollination. (Skogerboe-Colorado State)
W79-05295

THE ROLE OF SPRINKLER IRRIGATION IN PRODUCING SPECIALTY CROPS,
Patterson Farms, China Grove, NC.
C. Patterson.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc, Silver Spring, MD. 1978. p 124-125.

Descriptors: *Sprinkler irrigation, Frost protection, Freezing, Tomatoes, Strawberries, North Carolina.

The benefits of using a solid set sprinkler irrigation system for frost and freeze protection of tomato and strawberry production in North Carolina were discussed. (Skogerboe-Colorado State)
W79-05296

FACTORS INFLUENCING SYSTEM SELECTION IN HUMID REGIONS,
Auburn Univ., AL. Cooperative Extension Service.
L. M. Curtis.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc, Silver Spring, Md. 1978, p 126-130. 5 fig.

Descriptors: Irrigation, Humid areas, *Humid climatees, Southeast United States, Irrigation systems, *Sprinkler irrigation.

Factors and difficulties that should be evaluated in considering cable tow and center pivot irrigation systems on farms in the Southeast United States were discussed. The following factors have been analyzed: (1) water supply; (2) topography and surface characteristics; (3) crops grown and rotation schemes; and (4) economic considerations. It was concluded that the factors influencing system selection in the Southeast are numerous. The less favorable factors may slow or prohibit develop-

ment of irrigation in some areas. However, continued expansion of irrigated cropland appears likely as farmers incorporate irrigation as a production or management tool in their overall farming operation. (Skogerboe-Colorado State)
W79-05297

THE USE OF OVERTREE IRRIGATION FOR CROP COOLING AND FROST AND FREEZE PROTECTION ON APPLES,
North Carolina State Univ. at Raleigh. Dept. of Horticultural Science.
C. R. Unrath, and R. E. Sneed.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, MD. 1978, p 131-134.

Descriptors: *Sprinkler irrigation, Cooling, Freezing, *Frost protection, Apples, Peaches, Fruit crops, North Carolina.

Overtree irrigation for apple orchard cooling is an effective method of microclimate modification resulting in markedly improved fruit quality and greater grower returns. The experimental results showed that the evaporative cooling resulted in increased fruit coloration of red varieties' apples and increased sugar content, fruit size and reduced incidence of cork spot and bitter pit. The application rates of 0.16 in/hr to 0.18 in/hr were effective and provide higher water use efficiency than lower application rates. Overtree irrigation for frost and freeze protection was also evaluated and application rates between 0.16 in/hr to 0.18 in/hr were recommended for protection against 18 degrees to 20 degrees F conditions. (Skogerboe-Colorado State)
W79-05298

OPTIMIZING TRAVELING SPRINKLER SYSTEM PERFORMANCE,
Nelson Irrigation Corp., Walla Walla, WA.
B. Rupar.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., p 152-159, Silver Spring, Md. 1978. 5 fig, 1 tab.

Descriptors: *Sprinkler irrigation, Uniformity coefficient, Application equipment, Pressure head, Distribution pattern, Wind velocity.

Many factors affect the proper performance of traveling sprinkler irrigation systems. Among the most important considerations are uniformity of application, water droplet conditions and the application rate of the system. Test data, as well as actual field experience, confirm that a high degree of uniformity is achievable with a traveler, as long as proper lane spacing and travel direction are utilized, as well as proper arc setting and pressure. Acceptable droplet conditions can be achieved only through the use of adequate pressure and proper selection of trajectory angle for a given nozzle size. Application rates for travelers are sufficiently low to make them adaptable for most soil conditions. (Skogerboe-Colorado State)
W79-05299

INTRODUCTION TO IRRIGATION EFFICIENCY AND SCHEDULING,
California Univ., Parlier. Cooperative Extension.
F. K. Aljibury.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978, Irrigation Assoc., Silver, Spring, Md. 1978. p. 160-161, 1 tab.

Descriptors: *Irrigation efficiency, Scheduling, Water shortage, *Sprinkler irrigation, Consumptive use.

The subject of rational use of water is of vital interest. The allocation of existing supplies of water is becoming difficult and controversial. Irrigation efficiency and scheduling concepts play important roles in this context. Terms used to describe irrigation and water use efficiency are defined. (Skogerboe-Colorado State)
W79-05300

SOCIETAL ATTITUDES AND RESULTANT POLICIES CALL FOR WATER CONSERVATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
R. M. Hagan.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. 1978. p. 162-179.

Descriptors: *Water conservation, *Social aspects, Social impact, Social participation, Water policy, *Irrigation practices, Irrigation efficiency, Evapotranspiration, California.

The water situation and, to some extent, societal attitudes have changed dramatically in California within the past few months. This paper briefly touches on a number of aspects in order to provide a sample of the kinds of thoughts being expressed about irrigation agriculture, especially by environmental leaders. Several points are covered in some detail. (Skogerboe-Colorado State)
W79-05301

WATER EFFICIENCY WITH DEFICIT AND SUBOPTIMAL IRRIGATION,
California Univ., Parlier. Cooperative Extension.
F. K. Aljibury, M. Gerdts, and J. Beutel.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, OH., February 26-28, 1978. Irrigation Assoc., Silver Spring, MD. 1978, p 180-182, 3 tab.

Descriptors: Cultural control, Water shortage, Water conservation, *Furrow irrigation, Fruit crops, Irrigation systems, Irrigation efficiency, California.

Irrigation is considered one of the most important cultural practices in the arid and semi-arid irrigated areas of the world. The increasing demand for water and its limited supplies requires maximum efficiency in its use for irrigation. To achieve this end, many water specialists and plant scientists have been conducting studies to determine the effect of deficit irrigation on the production of food and fibrous crops. The objectives of such experiments are to maximize production under conditions of drought or limited water supplies. From experimental results it is concluded that the effect of deficit irrigation by furrow irrigation on the early growth of the plum trees was not significant. The deficit irrigation did not cause unusual leaf abscission or premature fruit drop. Total production was not affected but water savings was significant. The effect of deficit water treatments in the drip irrigated plots, on the soil water potential and deep moisture extraction was very evident. These irrigations did not affect the number of fruits per tree and bud initiation of future seasons significantly but produced fruits of smaller size. (Skogerboe-Colorado State)
W79-05302

COMPARATIVE EFFICIENCY OF IRRIGATION SYSTEMS,
Oregon State Univ., Corvallis.
M. N. Shearer.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio. February 26-28, 1978. Irrigation Assoc., Silver Spring, MD. 1978. p 183-188, 4 fig, 2 tab.

Descriptors: *Irrigation efficiency, Irrigation systems, Uniformity coefficient, *Sprinkler irrigation, Surface irrigation, Seepage, Runoff, Evaporation.

The purpose is to compare efficiencies obtainable with various irrigation systems having reasonably good designs. Also, several concepts of field irrigation efficiency have been discussed. (Skogerboe-Colorado)
W79-05303

IRRIGATION EFFICIENCY IN SCHEDULING,
Cornell Pump Co., Portland, OR.
G. Tribe.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. p. 189-191, 1978.

Descriptors: *Pumps, Pumping plants, Pump testing, Efficiencies, Design criteria.

Testing and experimentation have proven that a pump's ability to convert rotating kinetic energy to hydraulic pressure energy is predictable. This energy conversion efficiency can be improved by the application of engineering fundamentals. This paper discusses the need for improving pump efficiency and the factors which must be considered for improved pump design and to reduce the cost of ownership. (Skogerboe-Colorado State)
W79-05304

AUTOMATION OF SURFACE IRRIGATION,
Nebraska Univ., Clay Center. South Central Station.
D. E. Eisenhauer, and P. E. Fischbach.
In: Proceedings Irrigtion Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28m 1978. Irrigation Assoc., Silver Spring, Md. 1978. p. 196-205, 1 fig, 4 tab, 7 ref.

Descriptors: *Surface irrigation, *Automation, Automatic control, Irrigation efficiency, Irrigation systems, *Cost comparisons, Nebraska.

Efficient and low labor irrigation systems appear to be the way of the future. Automation of conventional gated pipe systems is a good way of improving efficiency and yet holding down labor requirements. The main additional component of the automatic system is the automatic valve. One valve is on the market now and another will be available soon. Design of automatic systems involves properly sizing pipeline and other components, using normal engineering criteria, plus designing for the proper field length and furrow stream size. Annual costs of automatic gated pipe is higher than conventional gated pipe systems, but recent trends in automatic sprinkler systems suggest that farmers are willing to invest the extra capital to reduce labor demands. (Skogerboe-Colorado State)
W79-05305

PRACTICAL SURFACE IRRIGATION,
West Side Pump Co., Los Palos, CA.
R. Gosling.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. 1978. p. 206-208.

Descriptors: *Surface irrigation, Sprinkler irrigation, Irrigation systems, Automation, Cost comparisons, Flexibility, California.

This paper discusses and makes a comparative analysis of gated pipe surface irrigation systems with respect to other systems. (Skogerboe-Colorado State)
W79-05306

MEASURING EFFICIENCY OF SURFACE IRRIGATION SYSTEMS,
Bennett and Bennett Irrigation Pipe Co., Hanford, CA.
S. C. Robinson.
In: Proceedings, Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. 1978. p. 209-212.

Descriptors: *Surface irrigation, *Irrigation efficiency, Application methods, Application equipment, Return flow, Irrigation systems, Border irrigation, Furrow irrigation, Sprinkler irrigation.

The concept of irrigation efficiency, the definition of application efficiency, and the various components of efficiency measurement of surface irriga-

tion systems were discussed. Rules were outlined which could be used in field applications to attain high application efficiency of surface irrigation systems. (Skogerboe-Colorado State)
W79-05307

SOLAR CELL IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
P. E. Fischbach, and R. W. Matlin.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. 1978. p. 213-217, 1 fig, 2 tab.

Descriptors: Irrigation, *Solar energy, Energy conversion, *Irrigation systems, Surface irrigation, Automation, Computer programs, Irrigation programs, Nebraska, Application equipment.

A large solar cell-powered crop irrigation system has been constructed on the University of Nebraska field laboratory in Mead, Nebraska. Success of the experimental irrigation system could demonstrate an alternate source of energy for irrigation. The photovoltaic cells used in the project, how they converted the solar energy to electrical energy and how the 80 acre-irrigation project was run and managed by the system were discussed. (Skogerboe-Colorado State)
W79-05308

EVALUATION CRITERIA FOR TRICKLE IRRIGATION EMISSION DEVICES,
Rain Bird Technical Services, Logan, UT.
K. Solomon.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. 1978. p. 218-225, 4 ref.

Descriptors: *Trickle irrigation, *Irrigation systems, Trickling filters, Clogging, Pressure head, Variability, Costs, Risks.

The emission device is sometimes referred to as the heart of a trickle irrigation system. It is important to compare the different types of emission devices available in order to choose wisely from among possible alternatives. This paper suggested and discussed some of the factors to be considered when judging and comparing emission devices. The following seven fundamental factors should be examined to select a particular emission device to use in a system: (1) General suitability; (2) Pressure-flow relationships; (3) manufacturing variability; (4) Flow rate sensitivity to water temperature; (5) Sensitivity to clogging; (6) Cost and (7) Risk. Some of these can be considered engineering performance factors, and hence can be measured and evaluated only subjectively. (Skogerboe-Colorado State)
W79-05309

TRICKLE DESIGN FOR MIDWEST CONDITIONS,
Farm Bureau Services, Inc., Hart, MI.
J. Gamble.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. 1978. p. 226-230.

Descriptors: *Trickle irrigation, Irrigation systems, Irrigation design, Clogging, Pipelines, Water shortage, Water conservation.

This paper discussed trickle irrigation design concepts, water resources used for this system in the midwest United States, and installation and operation criteria for such a system. Current problems facing the users and/or the installer of the system were also discussed. (Skogerboe-Colorado State)
W79-05310

TRICKLE IRRIGATION IN HUMID ZONES,
Louisiana State Univ., Baton Rouge. Dept. of Agricultural Engineering.
H. J. Braud.
In: Proceedings Irrigation Associaton, 1978 Technical Conference, Cincinnati, Ohio, February 26-18, 1978. Irrigation Assoc., Silver Spring, Md. 1978. p. 231-238, 2 fig, 2 tab, 6 ref.

Descriptors: Irrigation systems, *Trickle irrigation, Irrigation design, *Humid areas, Louisiana, Productivity, Citrus fruits, Sugarcane.

The need for irrigation in a humid area is specific to the particular crop-soil-climate. Not all crops respond to irrigation: Citrus does, but not sugarcane in Louisiana. Work group meetings of scientists interested or involved in trickle irrigation were held last year to define the most important problems of trickle irrigation. A regional research project draft was written, 'Trickle Irrigation in Humid Regions,' with the following objectives: (1) To determine water requirements and water management techniques; (2) To develop best procedures for applying N, P and K; (3) To determine causes of clogging in humid regions and develop methods to minimize it; (4) To optimize crop management practices; (5) To determine water and nutrient flow patterns and related root development; (6) To examine the costs, returns and profitability of trickle irrigation. Research on trickle is underway or planned at 17 state agricultural experiment stations and United States Department of Agriculture, Agricultural Research Service research stations. (Skogerboe-Colorado State)
W79-05311

BACTERIAL CLOGGING IN LOW PRESSURE IRRIGATION SYSTEMS,
Agricultural Research and Education Center, Lake Alfred, FL.
H. W. Ford.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Silver Spring, Md. 1978. p. 239-244, 2 fig, 7 ref.

Descriptors: *Irrigation systems, Low-flow augmentation, Clogging, Irrigation, *Bacteria, Slime.

Bacterial slimes are the fundamental cause of most clogging problems. There are no types of low pressure irrigation systems immune to slime clogging. Chlorine, when used in combination with suitable filtration, will control most of the slimes and associated agents that clog irrigation emitters. Chlorine, like other pesticides, requires a special use label in order to be used in drip irrigation systems. (Skogerboe-Colorado State)
W79-05312

IA SPRINKLER TEST STANDARDS,
Johns-Manville Sales Corp., Fresno, CA. Ag-Turf Div.
D. A. Bruce.
In: Proceedings Irrigation Association, 1978 Technical Conference, Cincinnati, Ohio, February 26-28, 1978. Irrigation Assoc., Silver Spring, Md. 1978. p. 282-289, 2 tab.

Descriptors: *Sprinkler irrigation, Testing procedures, Standards, Testing, Performance.

After many years of discussion, rejection and frustration, the irrigation industry is on the threshold of adopting a uniform method of testing sprinklers, collecting test data and reporting product performance. This paper outlines the sprinkler test procedure developed by a working committee formed by The Irrigation Association. The IA is attempting to issue a joint standard with the American Society of Agricultural Engineers. (Skogerboe-Colorado State)
W79-05313

EFFECT OF SOIL HUMIDITY ON NITRATE REDUCTASE ACTIVITY IN BARLEY SHOOT LEAVES (IN RUSSIAN),
Leningrad State Pedagogical Inst. (USSR).
For primary bibliographic entry see Field 2I.
W79-05314

CONTROL SYSTEM FOR IRRIGATION PUMPS,
J. J. Bode.
U.S. Patent No. 4,130,382, 5 p, 5 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 3, p 837, December 19, 1978.

Descriptors: *Patents, *Irrigation systems, *Irrigation efficiency, *Control systems, Rain, Pumps, Electronic equipment, Rain activated control systems.

A rain activated control system shuts off an irrigation pump when a predetermined amount of rainfall occurs. A receptable for catching rain is mounted in a manner to provide adjustment of the distance between its bottom and a pair of electrodes which extend into the receptacle. When rain is collected in the receptacle in sufficient quantity to immerse the electrodes, a control circuit is completed to operate a relay. The energized relay then activates the shut down system of the engine or motor which drives the irrigation pump. After a time delay sufficient to assure complete shut down of the pump, a timing circuit causes deenergization of the relay and closes a reset circuit. When the irrigation pump is to be restarted, the rain receptacle is emptied and a reset switch is opened to reset the control circuitry. (Sinha-OEIS)
W79-05373

SPRAY NOZZLE,
Senninger Irrigation, Inc., Orlando, FL. (Assignee).
M. Healy.
U.S. Patent No. 4,130,247, 4 p, 3 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 3, p 792, December 19, 1978.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Nozzles.

A spray nozzle apparatus and a method of making a spray nozzle in which a variety of nozzle sizes can be made using several common components is described. The nozzle head had a threaded base for attachment to a water line which base has an opening passing through for mounting removable nozzle inserts with retainer rings. A water-deflecting portion is mounted to the base so that a curved portion will deflect water at a predetermined angle. The curved deflector is attached to the base with a single screw and a pair of positioning studs. The invention is directed towards a spray nozzle producing a flat spray which is made of a polymer material and thus provides a surface which acts partially as a solid lubricant and having some small amount of resilience. (Sinha-OEIS)
W79-05374

AUTOMATIC LIQUID FLOW CONTROL DEVICE,
D. D. Moore.
U.S. Patent No. 4,130,135, 5 p, 4 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 3, p 755, December 19, 1978.

Descriptors: *Patents, *Irrigation, *Controls, *Flow control, Irrigation practices, Irrigation efficiency, Application equipment, Valves, Automatic control.

The automatic liquid flow control valve includes a waterwheel and a timer which can be set to start or stop the waterwheel at a predetermined time. The waterwheel is located within a liquid-tight valve housing. The valve housing includes an inlet and outlet. Both the inlet and the outlet may comprise coupling means for mounting the valve in a liquid supply line. The waterwheel, when held in a stationary position, prevents liquid from passing through the housing. When the waterwheel is allowed to rotate liquid will freely flow through the housing. The invention is specifically designed to be used as part of a system for watering gardens, lawns or fields. The device allows irrigation at night with the flow of water being started or stopped or, alternatively, started and then stopped at a predetermined time or times. (Sinha-OEIS)

W79-05375

WIND CORRECTION METHOD AND APPARATUS FOR IRRIGATION SYSTEMS,
Reinke Manufacturing Company, Deshler, NE. (Assignee).
R. J. Coash.
U.S. Patent No. 4,128,205, 6 p, 8 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 1, p. 115, December 5, 1978.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Wind, Irrigation efficiency, Irrigation practices, Application equipment, Wind sensor.

A device controls the discharge of liquid from an elevated spray head according to the wind conditions. A wind sensor is mounted near the end of an irrigation boom or other elevated pipe. An end spray head for the boom is controlled by a motor driven valve. When the sensor detects wind along the boom above a selected velocity, a circuit is activated to operate the valve motor in a manner to turn the spray head off or on, depending on the wind direction. The circuit includes time delays relays which disregard sudden gusts of wind. (Sinha-OEIS)
W79-05379

WATER DRIVE SYSTEM FOR A CENTER PIVOT IRRIGATION UNIT OR THE LIKE,
Lindsay Mfg. Co., NE. (Assignee).
K. E. Arndt, L. E. Otto, Jr., and D. A. Siekmeier.
U.S. Patent No. 4,127,181, 10 p, 7 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 4, p. 1157, November 28, 1978.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Application equipment, Irrigation efficiency, Irrigation practices, Hydraulics.

A water drive system for a center pivot irrigation system has a string of pipe which pivots in a circle or oscillates about a center pivot or upright. The pipe is supported on towers at intervals and each tower is independently driven by a power mechanism which is operated by the pressure of the water in the string of pipe. The system includes a mechanism to prevent one or more of the towers from rolling ahead on a downhill slope, a diaphragm valve arrangement for controlling the cycling of the drive, and an enlarged bellows or bladder for operating the water drive mechanism. (Sinha-OEIS)
W79-05387

IRRIGATION APPARATUS,
G. Gilead.
U.S. Patent No. 4,126,998, 5 p, 9 fig, 17 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 4, p 1096, November 28, 1978.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Subsurface irrigation, Application equipment, Irrigation efficiency, Irrigation practices.

Irrigation apparatus comprises first and second layers of sheet material, at least one of the first and second layers being configured in relief and the first and second layers being bonded together at touching surfaces so that the bonding defines a liquid conduit. There is at least one pressure reducing path associated with it and an exit port from each of the pressure reducing path associated with it and an exit port from each of the pressure reducing paths. Fluid flows through the primary flow conduit, into the pressure reducing path and exits in a trickle through an exit port. (Sinha-OEIS)
W79-05389

THE ECONOMIC VALUE OF IRRIGATION WATER IN THE WESTERN UNITED STATES: AN APPLICATION OF RIDGE REGRESSION,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 6B.
W79-05399

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DRAINAGE DENSITY AT INDEX OF WATERSHED DEVELOPMENT,
Rice Univ., Houston, TX. Dept. of Environmental Engineering.
P. B. Bedient, W. C. Huber, and J. P. Heaney.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR4, Proceedings Paper 14249, p 373-387, December 1978. 6 fig, 6 tab, 22 ref.

Descriptors: *Drainage density, *Environmental effects, *Florida, *Land use, *Drainage programs, Water pollution sources, Water quality, Data collections, Watershed management, Phosphorus, Geomorphology, Drainage patterns(Geologic), *South Florida, *Kissimmee River Basin, *Lake Okeechobee Basin, Stream geometry.

A methodology was presented to predict environmental impacts using drainage characteristics of developing watersheds in South Florida. These watersheds have been undergoing extreme changes in land use, drainage patterns, and water quality levels. An effort was made to quantify changes in drainage density, a measure of the total length of water courses per unit area of watershed, over the period 1953-1972 and to relate it to various parameters of watershed development. The use of 1:24,000 scale aerial photographs provided the measure of drainage network in the Kissimmee River Basin. It was found that increased drainage between 1953-1972 had produced a 223% increase in drainage density in the Lake Okeechobee Basin, due largely to artificial drainage activities. Concentrations and loading rates of total phosphorus from tributaries along the river were correlated with drainage density, and they indicate that the majority of the load is produced in intensively ditched areas. (Singh-ISWS)
W79-05034

TRANSIENT SUBSURFACE DRAINAGE ON SLOPING IRRIGATED LAND,
Bechtel, Inc., San Francisco, CA.
For primary bibliographic entry see Field 6A.
W79-05052

CONTROLLING IRRIGATION RUNOFF LOSSES WITH PROPER MANAGEMENT,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
D. W. Fitzsimmons, J. R. Busch, G. C. Lewis, and C. W. Berg.
Paper No 78-2090, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 14 p, 1 fig, 9 tab, 8 ref. ASAE, St Joseph Michigan.

Descriptors: *Surface runoff, Runoff, Tailwater, Erosion, Surface irrigation, Water loss, Sediment control, Nutrient removal, Irrigation effects.

Field investigations to determine the effectiveness of irrigation, tillage and other practices in controlling surface runoff and resulting pollutant losses from surface-irrigated fields were conducted during two irrigation seasons. The results indicate that water, sediment and nutrient losses can be reduced or eliminated by the use of proper management practices. (Skogerboe-Colorado State)
W79-05059

LAND USE EFFECTS ON CLAYPAN SOIL HYDROLOGY,
Science and Education Administration, Columbia, MO. North Central Watershed Research Center.
L. A. Kramer, and R. E. Burwell.
Paper No. 78-2070, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 14 p, 7 tab, 5 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Land use, Water yield, Land management, Clays, *Surface runoff, Corn, Wheat, Fallowing, Pastures.

Water yield data from 0.02-acre research plots for a ten-year study period of constant land use treatments are presented. The SCS Curve Number Procedure for runoff prediction gave ten-year average annual runoff values very similar to the observed land cover of fallow, continuous corn, small grain, and rotation meadow. (Skogerboe-Colorado State)
W79-05063

INTERACTING EFFECTS OF MINIMUM FLOW AND FLUCTUATING SHORELINES ON BENTHIC STREAM INSECTS,
Idaho Univ., Moscow. Dept. of Entomology.
For primary bibliographic entry see Field 2E.
W79-05233

ALGAE AND WATER POLLUTION,
For primary bibliographic entry see Field 5C.
W79-05322

OUTPUT OF WATER, SUSPENDED SEDIMENT, AND PHOSPHORUS FORMS FROM A SMALL AGRICULTURAL CATCHMENT,
Marlborough Catchment and Regional Water Board, Blenheim, (New Zealand).
For primary bibliographic entry see Field 5B.
W79-05344

SOME ASPECTS OF SEDIMENT DISTRIBUTION AND MACROPHYTE CYCLING OF HEAVY METALS,
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.
For primary bibliographic entry see Field 5C.
W79-05353

FLOW MEASUREMENT,
K. W. Martig, Jr.
U.S. Patent No. 4,127,030, 6 p, 3 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 4, p 1106, November 28, 1978.

Descriptors: *Patents, *Flow, *Flow measurement, Closed conduit flow, Flow rates, Flow characteristics, Flow depth.

Liquid flow through a sewer or water pipe or conduit is measured by admitting the liquid into a confining region of known dimensions from an open end of the pipe or conduit at such rate as to maintain the liquid depth constant in the pipe or conduit and determining the volume of liquid entering the region within a given time period. The depth in the pipe or conduit is conveniently monitored as static pressure of liquid, as is the depth in the confining region. Air is educted from the confining region as necessary to ensure admission of the liquid at the desired rate for constant in-pipe depth. (Sinha-OEIS)
W79-05388

KENNEBEC RIVER CORRIDOR PLAN – A MANAGEMENT PLAN FOR A REJUVENATED RESOURCE,
North Kennebec Regional Planning Commission, Winslow, ME.
For primary bibliographic entry see Field 6B.
W79-05402

KENNEBEC RIVER CORRIDOR PROJECT – APPENDIX II: WATER RESOURCES,
North Kennebec Regional Planning Commission, Winslow, ME.
For primary bibliographic entry see Field 6B.
W79-05404

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX III: FLOW REGULATION,
North Kennebec Regional Planning Commission, Winslow, ME.
For primary bibliographic entry see Field 6B.
W79-05405

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX IV: FLOODING,
North Kennebec Regional Planning Commission, Winslow, ME.
For primary bibliographic entry see Field 6B.
W79-05406

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX V: MANAGEMENT PLAN,
North Kennebec Regional Planning Commission, Winslow, ME.
For primary bibliographic entry see Field 6B.
W79-05407

VARIABILITY OF ANNUAL NUTRIENT AND SEDIMENT DISCHARGES IN RUNOFF FROM OKLAHOMA CROPLAND AND RANGELAND,
Agricultural Research Service, Durant, OK. Water Quality Management Lab.
For primary bibliographic entry see Field 5C.
W79-05429

4B. Groundwater Management

SUBSURFACE DRAINAGE OF AN ALLUVIAL CLAY SOIL FOR SOYBEANS,
Science and Education Administration, Baton Rouge, LA.
C. E. Carter, and C. R. Camp.
Paper No. 78-2040, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 6 p, 3 fig, 2 tab, 7 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Subsurface drainage, Subsurface drains, Soybeans, *Crop response, Crop production, Clays, Louisiana.

A subsurface drainage field experiment was conducted on a 4 ha site of an alluvial clay soil in Tensas Parish, Louisiana, during 1974-1977. Subsurface drains spaced 7.5 and 15 m apart did not effectively control the water table but the soil water regime near the drains was improved somewhat. Soybean yields were significantly increased by this improved drainage three of four years with drains spaced 7.5 m apart and two of four years with drains spaced 15 m apart. (Skogerboe-Colorado State)
W79-05053

ANNUAL SUMMARY OF GROUND-WATER CONDITIONS IN ARIZONA, SPRING 1977 TO SPRING 1978,
Geological Survey, Tucson, AZ. Water Resources Div.
Geological Survey Water-Resources Investigations 78-144 (open-file report), November 1978. 2 sheets, 23 ref.

Descriptors: *Arizona, *Groundwater, *Maps, *Water levels, *Pumping, *Drawdown, Irrigation, Water yield, Groundwater availability, Water supply.

The withdrawal of ground water was about 5.5 million acre-feet in Arizona in 1977. About 4.7 million acre-feet of ground water was used for the irrigation of crops in 1977. The Salt River Valley and the lower Santa Cruz basin are the largest agricultural areas in the State. For 1973-77, ground-water withdrawal in the two areas was about 8.1 and 5.1 million acre-feet, respectively, and, in general, water levels are declining. Other areas in which ground-water withdrawals have caused water-level declines are the Willcox, San Simon, upper Santa Cruz, Avra Valley, Gila Bend, Harquahala Plains, and McMullen Valley areas. Two small-scale maps of Arizona show (1) pumpage of ground water by areas and (2) the status of the ground-water inventory in the State. The main map, scale 1:500,000, shows potential well production, depth to water in selected wells in spring 1978, and change in water level in selected wells from 1973 to 1978. The brief text that accompanies the maps summarizes the current ground-water conditions in the State. (Woodard-USGS)
W79-05151

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--MISSOURI BASIN REGION,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-05152

QUANTITATIVE HYDROGEOLOGY OF THE UPPER REPUBLICAN NATURAL RESOURCES DISTRICT, SOUTHWEST NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
E. G. Lappala.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 135, Price codes: A10 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-38, June 1978. 200 p, 41 fig, 10 plates, 81 ref.

Descriptors: *Groundwater mining, *Irrigation wells, *Withdrawal, *Drawdown, *Model studies, Computer models, Projections, Surface-groundwater relationships, Surface waters, Hydrogeology, Soil water movement, Vegetation, Aquifers, Groundwater recharge, Water level fluctuations, Groundwater availability, Water demand, Evaluation, *Nebraska, *Ogallala formation.

Ground-water use for irrigation from the Ogallala Formation has increased rapidly in the Upper Republican Natural Resources District in southwest Nebraska. Water levels declined as much as 16 feet between 1952 and 1975. Discharge of the aquifer to streams was reduced by as much as 19 percent between 1967 and 1975. Quantification of the hydrogeologic system was provided by the development, testing and use of simulation models describing the soil zone and ground-water/surface-water system. Models were linked through source-sink terms. The ground-water/surface-water model was used to predict changes in water levels and streamflow caused by unrestricted irrigation-well installation and by no new wells after 1975. Water levels may decline as much as 140 feet in two areas by 2000 if installation of new wells is unrestricted. By 2000, water-level declines over the remainder of the area would be less than 60 feet under continued development and less than 40 feet with no new wells after 1975. The base flow of Frenchman, Stinking Water, and Spring Creeks could be reduced by more than 90 percent with no new wells and eliminated by 1992 under continued development. (Woodard-USGS)
W79-05161

ARTIFICIAL RECHARGE ON LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
D. A. Aronson.
Long Island Water Resources Bulletin LIWR-9, 1978. 25 p, 9 fig, 1 tab, 38 ref.

Descriptors: *Artificial recharge, *Groundwater recharge, *Injection wells, *Reclaimed water, *Ponding, Water reuse, Water quality, Water management(Applied), New York, *Long Island.

In eastern and central Long Island, N.Y., the ground-water supply has been diminished by the demands of continued population growth and the loss of replenishment since the advent of sewering. In addition, the quality of ground water is threatened locally by the discharge of effluents from septic tanks, cesspools, and industries and by saltwater intrusion near the shorelines as a result of heavy pumping. The use of highly treated wastewater (reclaimed water) to replenish the ground-water supply on Long Island seems to be both feasible and economical. Two methods that have been tested are injection of reclaimed water into the ground through wells, and ponding it in basins for infiltration to the water table. Major hindrances to these methods are well clogging by suspended particles in the injectant and clogging of the infiltration surface of the basin. Both can be controlled by adequate treatment of reclaimed water prior to recharge and by proper maintenance of infiltration surfaces. (Woodard-USGS)
W79-05169

DEFINING UPPER LIMITS TO GROUNDWATER DEVELOPMENT IN THE ARID WEST,
Montana State Univ., Bozeman.
O. R. Burt, R. G. Cummings, and J. W. McFarland.
American Journal of Agricultural Economics, Vol 59, No 5, p 943-947, December 1977. 2 tab, 5 equ, 9 ref.

Descriptors: *Groundwater development, *Optimum development plans, *Steady-state level, Water withdrawal, Groundwater storage, Methodology, Natural resources, Groundwater supply, Dynamic optimization, Information feedback, Costs, Annual, Linear programming, Polynomial, Agriculture, Income, Economic rate, Systems analysis, Conceptual model.

Groundwater development over the past twenty years in the western states has almost consistently followed a pattern of overdevelopment. The result has been rapid mining and thus depletion of the stock. This paper asserts that this problem might be avoided, or perhaps diminished, if at the outset groundwater development plans were considered in the context of the optimal steady-state level for groundwater stocks and rates of natural recharge. The 'optimal steady-state stock' is the level of groundwater storage at which mining optimally ceases and withdrawals become limited to natural recharge. Developed is a general methodology for determining such steady-state levels in natural resource systems; data from a case study of groundwater use in the Estancia Valley (New Mexico) are used to exemplify the usefulness of the approach. It is shown that it is possible to calculate the dynamic optimization problem's steady-state stock without going through the dynamic optimization process. The lines of argument developed parallel the general philosophy that underlies adaptive control processes developed in recent years; this refers to the information 'feedback' that can occur over time with operational experience. Thus, in the case of groundwater development, one begins with limited hydrologic information which is often based on general information as to geological formulations. Elementary hydrologic information is obtained only as drilling and pumping take place. Thus early estimates for groundwater storage must be viewed as tentative and subject to modification as additional data become available, implying the need for relatively simple and flexible computational techniques. (Bell Graf-Cornell)
W79-05271

4C. Effects On Water Of Man's Non-Water Activities

ANALYSIS OF URBAN STORM-WATER-QUALITY FROM SEVEN BASINS NEAR PORTLAND, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 5B.
W79-05156

RECONNAISSANCE ASSESSMENT OF EROSION AND SEDIMENTATION IN THE CANADA DE LOS ALAMOS BASIN, LOS ANGELES AND VENTURA COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Re-

sources Div.
For primary bibliographic entry see Field 2J.
W79-05172

COASTAL MORPHOLOGY, OIL SPILL VULNERABILITY AND SEDIMENTOLOGY OF KOTZEBUE SOUND AND KODIAK ISLAND,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-05213

THE EFFECTS OF OIL ON TEMPERATURE REGULATION IN SEA OTTERS,
Scripps Institution of Oceanography, La Jolla, CA. Physiological Research Lab.
For primary bibliographic entry see Field 5C.
W79-05214

EVALUATION OF THE EFFECTS OF URBANIZATION ON STORMWATER RUNOFF AND QUALITY,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
D. E. Overton, R. A. Minear, W. L. Troxler, R. S. Brown, and E. C. Crosby.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 513, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Center, University of Tennessee, Research Report No. 65, September 1978. 184 p. OWRT A-046-TENN(3). 14-34-0001-8045.

Descriptors: Watershed hydrology, Mathematical models, *Storm runoff, *Urbanization, Urban watersheds, Nonpoint pollution, Heavy metals, Minerals, Nutrients.

Results of analysis of stormwater runoff and quality from four small urban watersheds in Knoxville, Tennessee, are presented in two parts: Part 1 is on Stormwater Hydrographs and Part 2 is on Stormwater Quality. A third part presents the mathematical models developed in the course of the study for simulating storm hydrographs, suspended sediment pollutographs and loads, and sediment delivery ratios. There is apparently a wide range of effects of dustfall and urban stormwater quality on a contaminant-by-contaminant basis. Certain constituents such as COD, Hg, Cl, Pb, SiO2, PO4, and As significantly influence stormwater quality. Likewise COD, Hg, Cl, As, and PO4 levels found in the stormwater were caused primarily by dustfall. The relative magnitude of the constituents will have to be verified by further study. This verification would logically lead to the potential control of pollutants by: controlling the source of air contaminants, better sanitary street practices to collect the contaminants before they enter the water, and treatment after they enter the water system. Results from the removal model indicate that basically, there are two distinct but overlapping groups of contaminants found in the urban watershed. One group is the minerals and solids which have relatively constant concentrations from storm to storm and the other group is heavy metals, nutrients, and COD which have decreasing concentration with increasing runoff.
W79-05400

4D. Watershed Protection

BIOLOGICAL ASSESSMENT OF TIMBER MANAGEMENT ACTIVITY IMPACTS AND BUFFER STRIP EFFECTIVENESS ON NATIONAL FORESTS STREAMS OF NORTHERN CALIFORNIA,
California Univ., Berkeley. Dept. of Forestry and Conservation.
For primary bibliographic entry see Field 5C.
W79-05005

PREDICTION OF SOIL LOSS ON CROPLAND WITH REMOTE SENSING,
Texas Christian Univ., Fort Worth. Dept. of Geology.
For primary bibliographic entry see Field 7B.
W79-05148

SUMMARY OF WATERSHED CONDITIONS IN THE VICINITY OF REDWOOD NATIONAL PARK, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. J. Janda.
Geological Survey open-file report 78-25, 1977. 82 p, 12 fig, 2 tab, 28 ref, append.

Descriptors: *Erosion, *Erosion control, *Land use, *Lumbering, *Sediment transport, Channel erosion, Channel morphology, Landslides, Floods, Storms, Aggradation, California, *Redwood National Park, *Redwood Creek.

The Redwood Creek Unit of Redwood National Park, Calif., is located in the downstream end of an exceptionally rapidly eroding drainage basin. Although intense storms control the timing and general magnitude of major erosion events, the movement, types, and amounts of erosion occurring during those events are substantially influenced by land use. Erosional impacts of past timber harvest in the basin reflect primarily the cumulative impact of many small erosion problems caused not so much by removal of standing timber as by the pattern of ground surface disruption accompanying removal. Recently modified riparian and aquatic environments reflect stream channel adjustments to recently increased water and sediment discharges, and are classified by the National Park Service as damaged resources because the modifications reflect, in part, unnatural causes. Natural debris barriers along stream flowing through remaining old-growth forest have temporarily stored substantial quantities of sediment introduced into streams by recent storms and upstream land-use changes. Removal of merchantable timber from these barriers may destroy their stability and cause rapid release of stored sediment. Additionally, massive erosion in some recently harvested areas suggest that they are so erosionally sensitive that following rehabilitation and reforestation, they should not be reharvested. (Woodard-USGS)
W79-05170

SILT BARRIERS AS EROSION POLLUTION CONTROL IN A LARGE RECREATIONAL LAKE,
Federal Highway Administration, Tallahassee, FL. Florida Div.
E. G. Rivers, and C. J. Allen.
In: Mitigating Adverse Environmental Effects of Highway Construction; Transportation Research Record 551, p 12-24, 1975. 12 fig, 2 tab, 15 ref.

Descriptors: *Erosion control, *Lakes, *Environmental effects, *Highways, *Florida, Silts, Road construction, Pollutants, Soil erosion, Barriers, On-site investigations, Turbidity, Sedimentation, Sampling, Evaluation, Analysis, Water pollution sources, Lake sediments, On-site data collections, *Lake Jackson(FL), Silt barriers, Floating silt barriers.

Soil erosion from urban development and Interstate highway construction during the winter and spring of 1972 and 1973 resulted in extensive runoff pollution of Lake Jackson, a large recreational lake in northern Florida. Turbidity levels in mid-lake reached levels of 180 Jackson turbidity units, and portions of the lake reached turbidity levels exceeding 500 Jackson turbidity units. Floating silt barriers we deployed in 2 arms of the lake by the Florida Department of Transportation to abate the movement of turbid waters into the main body of the lake. Sediment core analyses were performed to determine the extent of sedimentation that had occurred, and water turbidity was monitored to determine the effectiveness of the silt barriers. Clay and silt fines were found to be the major factor in creating turbid conditions in the lake. Erosion controls were effective in controlling movement of sand-size sediments, but they were ineffective in controlling clays and silts. The silt barriers were up to 93% effective in preventing the movement of suspended silt and clay into the main body of the lake. Floating silt barriers can be a significant tool in confining suspended solids to localized areas in aquatic environs. However, silt barriers should not be relied on as a sole means to control erosion pollution. (See also W79-05235) (Humphreys-ISWS)
W79-05237

BETTER GRASSES FOR ROADSIDES,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Soils and Crops.
For primary bibliographic entry see Field 6G.
W79-05238

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SOME RESULTS FROM RECENT CHEMICAL STUDIES AT KILAUEA VOLCANO, HAWAII,
Hawaii Univ., Honolulu. Dept. of Chemistry.
J. J. Naughton, J. B. Finlayson, and V. A. Lewis.
Bulletin Volcanologique, Vol. 39, No. 1, p 64-69, Jan 1975. 2 fig, 7 ref. OWRT A-046-HI(1).

Descriptors: *Volcanoes, Hawaii, Fume.

The chemical surveillance of Kilaeua volcano, Hawaii, has continued. No relationship has thus far been identified between the helium content of an associated fumarole and the activity at the volcano. Fume samples from Halemaumau crater in Kilauea caldera and from a fissure eruption that occurred nearby on the floor of the caldera during August 1971 were examined for their halogen (Cl and F) and sulfur contents. The ratio of Cl/F in fume showed an abnormal increase in samples taken at Halemaumau a month before the eruption. This change in ratio may be a helpful indicator of the onset of eruption in volcanic areas.
W79-05003

FUME COMPOSITIONS FOUND AT VARIOUS STAGES OF ACTIVITY AT KILAUEA VOLCANO, HAWAII,
Hawaii Univ., Honolulu. Dept. of Chemistry.
J. J. Naughton, V. Lewis, D. Thomas, and J. B. Finlayson.
Journal of Geophysical Research, Vol. 80, No. 21, p 2963-2966, July 20, 1975. 1 fig, 2 tab, 22 ref. OWRT A-046-HI(2).

Descriptors: *Volcanoes, Hawaii, Fume.

Fume was collected at Kilauea Volcano with equipment patterned after that used in industrial pollution studies. Particulates and some of the gases present were separated. The fume analyzed was collected from Halemaumau crater in a noneruptive state, from Mauna Ulu lava lake with mild lava fountaining, and from vigorous but short-lived fountaining from fissures across the floor of Kilauea caldera. The chief components were SO2, SO4, Cl, Na, Ca, K, F, Mg, and Fe in about that order of decreasing concentration. Content and order of abundance varied depending on the state of activity of the volcanic sources of the fume. Sulfur compounds were preponderant.
W79-05004

DEVELOPMENT AND EVALUATION OF A TWO-STEP MEMBRANE FILTER METHOD FOR FECAL COLIFORM RECOVERY IN CHLORINATED SEWAGE EFFLUENTS,
Illinois State Water Survey, Urbana.
S. D. Lin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 146, Price codes: A02 in paper copy, A01 in microfiche. Report of Investigation 87, 1978. 14 p, 6 fig, 9 tab, 28 ref.

Descriptors: *Sewage effluents, *Testing procedures, *Coliforms, *Laboratory tests, Analytical techniques, Analysis, Chlorination, Sewage treatment, Filters, Membranes, Water pollution sources, Waste water(Pollution), Bacteria, Sewage bacteria, Fecal coliform, Bacteria analysis, Chlorinated wastewater effluents, Membrane filter method.

The standard one-step M-FC broth membrane filter (MF) procedure for recovery of fecal coliform (FC) in chlorinated wastewater effluents is much less effective than the multiple-tube (most probable number, MPN) technique. A two-step MF method was developed. Using a pre-enrichment technique with pheniol red lactose broth and incubation at 35C for 4 hours, followed by plating on M-FC agar and incubation at 44.5C for another 18 + or - 2 hours, enhanced FC recovery in chlorinated effluents. The results of 126 comparisons using chlorinated effluents from five wastewater plants showed that FC recovery with the two-step MF method is comparable to that with the MPN procedure. In the development of the two-step MF method for FC recovery in chlorinated effluents, only the Millipore HC filters were used. Literature shows that different bacteria recovery capabilities are reported for various membranes. Therefore, nine other types of membranes were compared with Millipore HC for their fecal coliform recovery in chlorinated effluents from the five wastewater treatment plants. The results of 61 comparisons were analyzed by Duncan's multiple range test. The 10 membranes can be divided into four groups. Millipore HC, Gelman GN-6, and Sartorius SM 138 06 (green) are equivalent and give the highest FC recovery in chlorinated effluents. The next group is Helena Titan GH, Nuclepore N 040, Sartorius SM-137 56, and Schleicher and Schuell (S and S) BC 07. Johns-Manville (J-M) sterilized and S and S B-9 belong to the other group and have an FC recovery better than J-M radiation. The J-M radiation gives the lowest FC recovery rate in chlorinated effluents. In all, 1002 blue colonies from all types of filters were isolated for fecal coliform verification. Average verification was 93.2%. (Humphreys-ISWS)
W79-05012

SYSTEMATIC DIURNAL CURVE ANALYSIS,
Hickok (Eugene A.) Associates, Wayzata, MN.
For primary bibliographic entry see Field 5B.
W79-05042

GEOGRAPHICALLY VARIABLE WATER QUALITY INDEX USED IN OREGON,
Oregon State Dept. of Environmental Quality, Salem. Water Quality Div.
For primary bibliographic entry see Field 5B.
W79-05043

COPPER, NICKEL, AND ZINC RELEASED FROM ACID COAL MINE SPOIL MATERIALS OF EASTERN KENTUCKY,
Kentucky Univ., Lexington. Div. of Regulatory Services.
A. F. Massey, and R. I. Barnhisel.
Soil Science, Vol. 113, No. 3, p 207-212, 1972. 4 tab, 14 ref.

Descriptors: *Strip mines, *Appalachian Mountain region, *Toxicity, *Soil chemical properties, *Kentucky, Copper, Nickel, Zinc, Mine wastes, *Pollutant identification.

Toxicity from copper, nickel and zinc may be a problem in revegetating coal mine spoil banks. Concentrations of zinc, copper and nickel as high as 145, 85 and 122 ppm respectively were found in spoil solution. (Curtis-Forest Service)
W79-05044

INFLUENCE OF DILUTION WATER ON THE TOXICITY OF KRAFT PULP AND PAPER MILL EFFLUENT, INCLUDING MECHANISMS OF EFFECT,
British Columbia Research Council, Vancouver. Div. of Applied Biology.
D. J. McLeay, C. C. Walden, and J. R. Munro.
Water Research, Vol. 13, p 151-158, 1979. 4 fig, 4 tab, 27 ref.

Descriptors: *Pulp wastes, *Toxicity, *Hydrogen ion concentration, Industrial wastes, Chemical wastes, Resins, Acids, Bleaching wastes, Pulp and paper industry, Bioassay, Rainbow trout, Mortality, Juvenile growth stage, Methodology, *Dehydroabietic acid.

Ten natural freshwater samples differing widely in pH and other characteristics were collected and examined for their influence as dilution waters on the acute lethality (24-h LC50 values) of a sample of bleached kraft whole mill effluent. When bioassays were conducted at the pH of each dilution water, LC50 values varied by 3.5-fold. These differences were largely accounted for by adjustment of the pH of each test solution to a common value (6.5). The remaining minor differences in LC50 values were attributed to the ionizable inorganic constituents of the dilution waters. A separate study examined the effects of test pH and the involvement of aging of solutions prior to bioassays or of pH overshoots during pH adjustment on the toxicity of a second sample of pulp mill effluent; using a single dilution water. The LC50 values obtained for bioassays conducted at pH 9.5 were significantly higher than those for tests performed at pH 6.5. Neither the adjustment of test solutions to pH 9.5 with immediate readjustment to pH 6.5, nor the prior aging of solutions at pH or 6.5 with minimal or no aeration for 6h, altered the differences due to test pH. (Deal-EIS)
W79-05105

THE NATURE OF METALS-SEDIMENT-WATER INTERACTIONS IN FRESHWATER BODIES, WITH EMPHASIS ON THE ROLE OF ORGANIC MATTER,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Petroleum Exploration Branch.
K. S. Jackson, I. R. Jonasson, and G. B. Skippen.
Earth-Science Reviews, Vol. 14, p 97-146, 1978. 6 fig, 2 tab, 227 ref.

Descriptors: *Metals, *Sediments, *Organic matter, Humic acids, Fulvic acids, Geochemistry, Organic compounds, Ions, Chemical reactions, Chemical properties, Chemical analysis, Heavy metals, Adsorption, *Copper, *Cobalt, *Zinc, *Mercury, *Nickel, *Lead, Manganese, Magnesium, Path of pollutants, *Ligands.

The review is divided into two main sections, viz, nature and properties of humic matter, and water-metal-sediment interactions. The first section deals with the essential properties of organic matter which occurs naturally in drainage sediments and waters. Discussion of the basic molecular structure of humic and fulvic acids is followed by some details of the chemical nature of functional groups within these structures which are important in metal-ion adsorption and complexing reactions which these materials can undergo. Information is also presented for colloidal and polyelectrolyte properties, complexation properties, and finally a summary discussion of metal-ion--humic-acid, metal-ion--fulvic-acid stability constants for both single ligand and mixed ligand systems completes the section. The second section comprises discussions of some specific aspects of interactions between metals, sediments and waters, including metal and organic speciation studies; sorption interactions between organic matter, clays and humic acids; chemical reaction between humic acids, heavy-metal minerals, clays and other silicate minerals; metal-ion adsorption--desorption studies, oxidation--reduction reactions between metal ions and humic acids; effects of sulphide ion on some of the above interactions and finally a summary of some relevant field geochemical dispersion studies. (Deal-EIS)
W79-05106

TOXICITY OF COPPER TO CUTTHROAT TROUT (SALMO CLARKI) UNDER DIFFERENT CONDITIONS OF ALKALINITY, PH, AND HARDNESS,
Maine Univ. at Farmington. Dept. of Chemistry.
C. Chakoumakos, R. C. Russo, and R. V. Thurston.
Environmental Science and Technology, Vol. 13, No. 2, p 213-219, 1979. 2 fig, 8 tab, 31 ref.

Descriptors: *Cutthroat trout, *Copper, *Toxicity, Bioassay, Rainbow trout, Fish physiology, Alkalinity, Hardness(Water), Hydrogen ion concentration, Copper compounds, Ions, Alkalis(Bases), Chemical analysis, Chemical properties, Water chemistry, Carbonates.

Median lethal concentration (96-h LC50) values for acute copper toxicity to 3-10g cutthroat trout have been determined for nine different combinations of alkalinity, hardness, and pH. Equilibrium calculations were performed on the copper LC50 values. Seven different soluble species of copper were considered: Cu2+, CuOH+, Cu(OH)20, Cu2-(OH)22+, CuHCO3+, CuCO30, and Cu(CO3)22-. The acute toxicity of copper was inversely correlated with water hardness and alkalinity. At a given alkalinity, hardness determined the LC50; at a given hardness, alkalinity determined the LC50. At a given alkalinity and hardness, the concentrations of the copper species were determined by the pH of the water. Under the conditions tested, Cu2+, CuOH+, Cu(OH)20, and Cu2(OH)22+ were toxic forms of copper to cutthroat trout; CuHCO3+, CuCO30, and Cu(CO3)22- were not toxic. Results of 11 96-h copper toxicity bioassays on 1- to 26-g rainbow trout under uniform water chemistry conditions are also reported. (Deal-EIS)
W79-05107

TROPHIC LEVEL ACCUMULATION OF HEAVY METALS IN A COAL ASH BASIN DRAINAGE SYSTEM,
Texas Univ. Health Science Center at Houston. School of Public Health.
R. K. Guthrie, and D. S. Cherry.
Water Resources Bulletin, Vol. 15, No. 1, p 244-248, 1979. 1 fig, 1 tab, 8 ref.

Descriptors: *Absorption, *Heavy metals, *Trophic level, Coals, Copper, Zinc, Cadmium, Aluminum, Iron, Chemical analysis, Neutron activation analysis, Water chemistry, Mercury, Food chains, Diptera, Sediments, Drainage systems, Crayfish, Livebearers, *Bioaccumulation, *Tissue analysis, *Selenium, *Barium, *Coal ash.

The uptake of ten chemical elements was measured in water, sediment, fly ash, and the major biotic components of an ash basin drainage system. The biota tested represent several trophic levels observed in the settling basin and receiving swamp of the system. Concentrations were measured by neutron activation in the major biotic groups including aquatic bacteria, algae, macrophytes, midges, dragonflies, crayfish, tadpoles, and fish. Only three elements (Cu, Zn, Cd) were more highly concentrated in water from a nearby unpolluted stream than in the fly ash effluent. Sediment concentrations of all elements were highest in the ash drainage system with Al and Fe being consistently highest. Among the biota, Hydrodictyon sp. and Lemna perpusilla had the highest concentrations of Al and Fe while other macrophytes were the major accumulators of Mn and Ba. Invertebrates generally concentrated high amounts of Cu and Zn although Cd and Hg were accumulated most by crayfish. Selenium was selectively concentrated by bacteria, crayfish (Procambarus sp.) and mosquitofish (Gambusia affinis). Consequences of elemental concentrations in sediment and in specific trophic level groups are discussed. (Deal-EIS)
W79-05108

THE USE OF SPECIES ABUNDANCE ESTIMATES IN MARINE BENTHIC STUDIES,
Maine Univ., Walpole. Ira C. Darling Center for Research, Teaching and Service.
L. Watling, P. C. Kinner, and D. Maurer.
Journal of Experimental Marine Biology and Ecology, Vol. 35, p. 109-118, 1978. 6 tab, 17 ref.

Descriptors: *Mathematical studies, *Benthic flora, *Plant populations, Analytical techniques, Bottom sampling, Dredging, Bottom sediments, Biological communities, Sampling, Plant groupings, Estimating equations, *Species diversity, Species diversity indices.

The application of species abundance estimates, commonly used in terrestrial plant ecology, to marine benthic dredge data is advocated. Two possible scales were tested for their ability to measure adequately the structure of an assemblage by computing measures of evenness diversity McNaughton's dominance index, and Morisita's index of dispersion using both real counts obtained from grab samples and these counts transformed into the two respective abundance estimates. It is concluded that species abundance estimators, when applied to grab or dredge data result in significant savings in sample processing time with only a minimal loss of information about assemblage structure. (Deal-EIS)
W79-05109

ANALYSIS OF CHLORINATED HYDROCARBON POLLUTANTS: A SIMPLIFIED EXTRACTION AND CLEANUP PROCEDURE FOR FISHERY PRODUCTS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
V. F. Stout, and F. L. Beezhold.
Fishery Bulletin, Vol. 76, No. 4, p. 880-886, 1979. 5 ref.

Descriptors: *Chemical analysis, *Chlorinated hydrocarbon pesticides, DDT, DDE, Polychlorinated biphenyls, Dieldrin, Chemical degradation, Laboratory tests, Analytical techniques, Chromatography, Chemical reactions, Aroclors, *Tissue analysis.

This paper is a laboratory manual, delineating details of a simple, rapid, and reliable method for the extraction and cleanup of samples of fish, fishery products, and paper for analysis of chlorinated hydrocarbons, such as PCB, dieldrin, and DDT and its metabolites TDE and DDE. The procedures can be adapted to a great variety of sample types. The method is economical since small amounts of solvents are used and the equipment and glassware are relatively inexpensive and readily available. (Deal-EIS)
W79-05110

A BIOASSAY LABORATORY BOAT WITH COMPARISONS OF CENTRAL VS. BOAT LABORATORY BIOASSAY EVALUATIONS,
Academy of Natural Sciences of Philadelphia, PA. Div. of Limnology and Ecology.
A. Scheier, W. Connell, and H. D. Gominger.
Water Resources Bulletin, Vol. 15, No. 1, p 75-87, 1979. 4 fig, 6 tab, 9 ref.

Descriptors: *Oil pollution, *Toxicity, *Bioassay, *On-site data collections, Research equipment, Oil, Organic compounds, Sunfishes, Channel catfish, Snails, Shrimp, Minnows, Chemical analysis, Chemical properties, Chemical reactions, Irradiation, Chemical degradation.

A laboratory boat designed to investigate toxic effects on site and its use as a bioassay tool in the study of a refinery effluent discharged into the Schuylkill River, a tributary of the Delaware River, is described. Three-hundred thirty-six-hour continuous-flow bioassays exposing the bluegill sunfish, the channel catfish, the tadpole snail, the grass shrimp, and the sheephead minnow to concentrations of refinery effluent in Schuylkill, Delaware River, and Delaware Bay water, with and without the addition of sediment were performed. Results indicated that the toxicity (lethality) of fresh samples tested aboard the boat (refinery effluent, dilution water, sediment) were considerably higher (i.e., refinery effluent at full strength was 2.2X as lethal to the bluegill, 1.4X as lethal to the channel catfish, 1.5X as lethal to the sheephead minnow and 100X as lethal to the grass shrimp) than the same test material collected from the refinery outfall and brought to a central laboratory for testing. Chemical analysis and bioassay data is presented showing the effects of aging and irradiation upon the refinery effluent. (Deal-EIS)
W79-05111

METHODS FOR DETERMINING THE OXYGEN CONSUMPTION OF A FISH UNDER CONDITIONS OF AQUATIC SEMI-CONFINEMENT (METHODES DE DETERMINATION DE LA CONSOMMATION D'OXYGENE D'UN POISSON DANS LES CONDITIONS DU SEMI-CONFINEMENT AQUATIQUE),
Amiens Univ. (France). Lab. de Physiologie.
J. Gorin, M. Freville, B. Dercumaux, and P. Harichaux.
Annales de Hydrobiologie, Vol. 8, No. 3, p. 355-362, 1977. 3 fig, 5 ref.

Descriptors: *Oxygen requirements, *Oxygen, *Chemical analysis, Fish physiology, Animal metabolism, Mathematical studies, Mathematical models, Laboratory tests, Analytical techniques, Water chemistry, Water analysis, Methodology.

Under conditions of aquatic semi-confinement, including a system of water renewal and a slight stirring, the oxygen consumption of a fish can be determined by registration of the variations of the oxygen partial pressure in the environment according to time. Two methods are set forth, the first one is based on graphic records and the second one results from a mathematical development. (Deal-EIS)
W79-05112

AN EVALUATION OF THE STATUS, LIFE HISTORY, AND HABITAT REQUIREMENTS OF THE ENDANGERED AND THREATENED FISHES OF THE UPPER COLORADO RIVER SYSTEM. PART TWO,
Ecology Consultants, Inc., Fort Collins, CO.
T. Joseph, J. Sinning, R. Bihnke, and P. Holden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 545, Price codes: A09 in paper copy, A01 in microfiche. Fish and Wildlife Service, U.S. Department of the Interior, Report No FWS/OBS-77/62, 193 p, 1977. 10 fig, 3 tab, 1 append, 134 ref.

Descriptors: *Colorado River, *Fish populations, Colorado River Basin, Water utilization, Water allocation(Policy), Reservoirs, Flow, Habitats, Ecosystems, Water quality, Dams, Trout, Cutthroat trout, Suckers, Lumbering, Mining, Water chemistry, Salinity, Suspended solids, Life history studies, *Endangered species.

The focus of this report is the endangered and threatened fishes of the Upper Colorado River system, but a full appreciation would not be possible without an adequate knowledge of the ecosystems in which they live. The six major sections of the report are: abiotic components, biological components, species description, river basin descriptions, major factors inducing environmental change, and urgent needs and recommended research priorities in regard to the upper Colorado River System. (Deal-EIS)
W79-05114

HEAVY METAL CONCENTRATIONS AT THE APEX OF THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.
J. E. Alexander, R. Hollman, and T. White.
NOAA Technical Memorandum ERL MESA-34, December 1978. 37 p, 11 fig, 15 tab, 26 ref, append.

Descriptors: *Heavy metals, *Pollutants, *New York, Cadmium, Cobalt, Copper, Iron, Lead, Mercury, Zinc, Nickel, Pollutant identification, New York Bight.

Particulate and total 'soluble' cadmium, cobalt, copper, iron, and lead, and total 'soluble' mercury concentrations were determined for 146 seawater samples collected on November 8-9, 1973, in the apex of the New York Bight. With few exceptions, particulate lead, cadmium, cobalt, and nickel concentrations were below the limits of detection for the analytical scheme used. The concentrations of particulate iron and copper and total 'soluble' nickel varied as a function of tide and sample locations. Most of the iron was in the particulate form. (NOAA)
W79-05117

GROUND-WATER POLLUTION--A LIMITED PROBLEM,
Dunn Geoscience Corp., Latham, NY.
For primary bibliographic entry see Field 5B.
W79-05122

GROUND-WATER QUALITY STANDARDS--A NEUTRAL VIEW,
Michigan Dept. of Public Health, Lansing.
For primary bibliographic entry see Field 5B.
W79-05123

DIP BASKET FOR COLLECTING JUVENILE SALMON AND TROUT IN GATEWELLS AT HYDROELECTRIC DAMS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
G. A. Swan, R. F. Krcma, and W. E. Farr.
The Progressive Fish Culturist, Vol. 41 No 1, p 48-49, 1979, 3 fig, 2 ref.

Descriptors: *Columbia River, *Snake River, *Little Goose Dam, Fishing gear, *Dams, Dam operations, *Gatewells, Juvenile fish, Salmon, Trout, Hydroelectric dams, Methodology, Fish migration, Fish conservation, Fish handling facilities, Fish guiding, Dip basket.

The design and operation of a dip basket for collecting fingerling salmon from modified gatewells at Little Goose Dam in the Snake River is described. 400 to 500 fingerlings could be accommodated in the bag. (Katz-EIS)
W79-05175

HATCHING TABLE FOR FISHERIES RESEARCH,
Washington Univ., Seattle. Coll. of Fisheries.
P. L. Hickey, W. K. Hershberger, and J. N. Dong.
The Progressive Fish Culturist, Vol. 41 No. 1, p 25-26, 1979. 1 fig, 2 ref.

Descriptors: *Methodology, *Water quality, Water pollution effects, Laboratory tests, *Laboratory equipment, Fish hatcheries, *Fish eggs, Mortalities, Chinook salmon, Hatching table, Fish physiology.

An incubation system is described that permits the incubation of many seperate groups of eggs with an equivalent water quality conditions. Containers are removable for ease of handling and data collection. (Katz-EIS).
W79-05178

RAPID VACUUM METHOD FOR REMOVAL OF MUCUS FROM THE EPIDERMIS OF FISHES,
Louisville Univ., KY. Dept. of Biology.
T. R. Kozel, and K. W. Dobra.
The Progressive Fish Culturist, Vol. 41, No. 1, p 18-19, 1979. 8 ref.

Descriptors: *Methodology, *Toxicity, *Freshwater fish, Laboratory equipment, Laboratory tests, *Water pollution effects, Chemical analysis, Fish physiology, Epidermis, Mucus, *Mucus removal, Fish epidermis.

A method is described of removing mucus from the epidermis of fish by a mild vacuum system. The mucus is available for microscopic examination. The procedure is useful for getting material for chemical and biological measurement. (Katz-EIS)
W79-05180

SELF-CONTAINED UPWELLING SYSTEM FOR REARING LARVAL FISHES IN THE LABORATORY,
Florida State Game and Freshwater Fish Commission, Boca Raton.
P. L. Shafland.
The Progressive Fish Culturist, Vol. 41, No. 1, p 10-13, 1979. 3 fig, 98 ref.

Descriptors: *Aquiculture, *Methodology, *Laboratory equipment, *Salinity, Sea water, *Juvenile fish, Mortality, Fish conservation, Fish establishment, Fish hatcheries, Laboratory tests, Fish reproduction, Juvenile growth stage, Snook, Centropomus, Aquaria.

The design and operation of a rearing and salinity conversion system is described. This system was developed and successfully used to rear snook from artificially fertilized eggs for the first time. Each chamber is individually plumbed to produce an upwelling current by introducing water at the bottom and discharging it near the top. Snook were reared through the early larval stages in salt water and then converted to fresh water. Use of this system enabled the evaluation of the foods, feeding behavior, and growth of larval snook under laboratory conditions; and investigations of the freshwater tolerance of young snook. (Katz-EIS)
W79-05182

MODIFICATIONS OF TEMPERATURE AVOIDANCE TROUGHS FOR TESTING SMALL FISHES,
Maryland Univ., Frostburg. Appalachian Environmental Lab.
E. L. Melisky, J. R. Stauffer, D. A. Cincutta, and C. H. Hocutt.
The Progressive Fish Culturist, Vol. 41, No. 1, p 44-45, 1979. 4 fig, 10 ref.

Descriptors: *Laboratory tests, *Bioassays, *Methodology, *Water temperature, Criteria, Laboratory equipment, Temperature Avoidance, Troughs, Aquatic environment, Thermal additions, Freshwater fish.

A temperature avoidance trough for small fishes is described. It is used to establish temperature criteria required to protect ecosystems against thermal additions to the aquatic environment. The design eliminated turbulence present in other models. (Katz-EIS)
W79-05185

EARLY SAMPLES OF OIL IN WATER AND SOME ANALYSES OF ZOOPLANKTON,
Torry Research Station, Aberdeen (Scotland).
P. R. Mackie, R. Hardy, E. I. Butler, P. M. Hulligan, and M. F. Spooner.
Marine Pollution Bulletin, Vol. 9, No. 11, p 296-297, 1978. 2 tab, 5 ref.

Descriptors: *Oil, *Oil spills, *Water pollution effects, *Amoco Cadiz, Water analysis, On-site-investigation, Petroleum hydrocarbons, *Zooplankton, Copepoda, Tissue fluorescence, Crude oil, Aromatic hydrocarbons, n-alkanes, Path of pollutants.

A cruise by the oceanographic vessel Sarsia was made to sample the waters in the areas polluted by the Amoco Cadiz spill. Analyses were made of the n-alkanes and the aromatics. Zooplankton taken by the Sarsia were analyzed for their aromatic content. Fluorescence in tissue of copepods showed some correlation with the expected degree of pollution. (Katz-EIS)
W79-05186

EDITORIAL INTRODUCTION,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
M. F. Spooner.
Marine Pollution Bulletin, Vol. 9, No. 11, p 281-284, 1978. 1 tab, 1 fig.

Descriptors: *Oil, *Oil spills, *Amoco Cadiz, Brittany, Light Arabian crude, Light Iranian crude, *Water pollution effects, *Detergents, Dispersants, Currents(Ocean), Mousse, Oil slicks, Toxicity, Plankton, Benthos, *Benthic fauna, Clean up, Costs, Tourism, Commercial fisheries.

The Nov 1978 issue of the Marine Pollution Bulletin is devoted entirely to the Amoco Cadiz oil spill. The supertanker was wrecked on 16 March, 1978, off Portsall, Brittany, with the loss of the entire cargo. Brief contributions have been widely invited from those engaged in research on the effects of this, the most serious spill in the history of oil pollution. A general introductory account has been given by Dr. L. Laubier, Directeur of the Centre Oceanologique de Bretagne, who summarized in June points of special interest (including fisheries aspects). Fuller reports are to be found elsewhere (listed at the end of this issue). It is inevitable that some important aspects have not been covered in the papers received and these subjects are briefly mentioned here. (Katz-EIS)
W79-05188

THE AMOCO CADIZ OIL SPILL-LINES OF STUDY AND EARLY OBSERVATIONS,
Centre Oceanologique de Bretagne Brest (France).
L. Laubier.
Marine Pollution Bulletin, Vol. 9, No. 11, p 285-287, 1978.

Descriptors: *Oil, *Oil spills, *Amoco Cadiz, *Water pollution effects, *Monitoring, Chemical analysis, *Environmental effects, Chemical analysis, Water quality, Sediments, Zooplankton, Benthos, Benthic animals, On-site-investigations, Petroleum, Hydrocarbons, Toxicity, Mortality, Bay of Morlaix, Brittany, Sea birds, Fate of oil, Benthic plants.

Following the Amoco Cadiz oil spill a research program was conducted by several French organizations, United States governmental, university and private organizations, by the Canadian Bedford Institute of Oceanography and by the Marine Biological Association of the United Kingdom. The program consists of monitoring the chemical quality of the water, the sediments, the marine organisms, studies of the ecological effects, microbiological processes and toxicological research. (Katz-EIS)
W79-05189

PETROLEUM HYDROCARBON ANALYSES CONDUCTED FOLLOWING THE WRECK OF THE SUPERTANKER AMOCO CADIZ,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.
R. J. Law.
Marine Pollution Bulletin, Vol. 9, No. 11, p 293-296, 1978. 5 tab, 2 fig, 7 ref.

Descriptors: *Oil, *Oil spills, *Water pollution effects, *Amoco Cadiz, Brittany, English Channel, On-site-investigations, Sediment, *Chemical analysis, Sea-Water, Sampling, Methodology, Monitoring, Gas chromatography, Biodegradation, Weathered oil, *Petroleum hydrocarbons.

Following the wreck of the Amoco Cadiz on 16 March 1978, samples of water, sediment and oil were collected between April and June from the Brittany coast and western English Channel and were analysed for petroleum hydrocarbons by means of fluorescence spectroscopy, gas-liquid chromatography and gas chromatography-mass spectrometry. (Katz-EIS)
W79-05196

ENVIRONMENTAL PATHWAYS OF SELECTED CHEMICALS IN FRESHWATER SYSTEMS PART II: LABORATORY STUDIES,
SRI International Menlo Park, CA.
J. H. Smith, W. R. Mabeu, N. Bohonos, B. R. Holt, and S. S. Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 511, Price codes: A19 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA-600/7-78-074, 432 p, May 1978. 93 fig, 165 tab, 235 ref.

Descriptors: *Fossil fuels, *Pesticide residues, *Pollutant identification, Chemical properties, Physiochemical properties, Chemical analysis, Pesticides, Organic compounds, Path of pollutants, Biodegradation, Persistence, Eutrophication, Trophic level, Oligotrophy, Microbial degradation, Chemical degradation, Absorption, *Methyl parathion, *Mirex, *Photolysis, Benzo(a)pyrene.

Environmental exposure assessment models and laboratory procedures for predicting the pathways of potentially harmful chemicals in freshwater environments were described in Part I of this report (EPA-600/7-77-113). Procedures were developed for measuring the rates of volatilization, photolysis, oxidation, hydrolysis, and biotransformations as well as the sorption partition coefficients on natural sediments and on a mixture of four bacteria. The results were integrated with a simple computer model to predict the pathways of chemicals in ponds, rivers, and lakes. This second part of the project report describes the successful application of these procedures to 11 chemicals of environmental interest. The chemicals were p-cresol, benz(a)anthracene, benzo(a)pyrene, quinoline, benzo(f)quinoline, 9H-carbazole, 7H-dibenzo(c,g)carbazole, benzo(b)-thiophene, and dibenzothiophene, which might be found in the effluents of plants using or processing fossil fuels, and methyl parathion and mirex, which are agricultural pesticides. (Deal-EIS)
W79-05198

MULTIPLE BOTTLE HOLDER FOR IN SITU MEASUREMENT OF PRIMARY PRODUCTIVITY,
Battelle Pacific Northwest Lab., Richland, WA.
D. A. Neitzel, T. L. Page, and E. G. Wolf.
The Progressive Fish Culturist, Vol. 41, No. 1, p 42-43, 1979. 1 fig, 4 ref.

Descriptors: *Methodology, *Laboratory apparatus, On-site-investigation, *Primary productivity, *Biochemical oxygen demand, Columbia River, Multiple bottle holder, In-situ measurements.

An apparatus is described for the in situ incubation of samples for primary productivity measurements at various depths. BOD samples have been incubated in the Columbia River at depths from 0.5 m. to 0.6 m. in currents up to 3.0 meters per second. (Katz-EIS)
W79-05201

ANNOUNCEMENT OF COMPOUNDS REGISTERED FOR FISHERY USES,
National Fishery Research Lab., LaCrosse, WI.
R. A. Schnick, and F. P. Meyer.
The Progressive Fish Culturist, Vol. 41, No. 1, p 36-37, 1979. 1 tab.

Descriptors: *Fish diseases, *Fish culture, *Aquiculture, Herbicide, Algicide, Lampricide, *Fish toxicant, Food fish, Pond sterilant, Anesthetic, Oxidizer, Detoxifier, Prophylactic, Parasiticide, Registration, Compounds for fishery use.

A special report on compounds approved for fishery use has been relesed by the Fish & Wildlife Service. The report is a summary of the chemicals for which fishery uses have been registered or exempted from registration and of four compounds for which the status is still indefinite. (Katz-EIS)
W79-05205

CONCENTRATIONS OF SELECTED ELEMENTS AND ASH IN BLUEGILL (LEPOMIS MACROCHIRUS) AND CERTAIN OTHER FRESHWATER FISH,
Breedlove Associates, Inc., Gainesville, FL.
J. A. Davis, and C. E. Boyd.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 862-867, 1978, 2 fig, 4 tab, 26 ref.

Descriptors: *Sunfishes, *Calcium, *Magnesium, *Potassium, *Sodium, Nitrogen, Phosphorus, *Sulfur, Fly ash, Chemical analysis, Fish physiology, Animal metabolism, Fish populations, Freshwater fish, Electro-fishing, Water chemistry, Industrial wastes, Chemical wastes, *Tissue analysis, *Ash.

Studies on the elemental composition of bluegills and other freshwater fish revealed that fish differ in concentrations of calcium, magnesium, potassium, sodium, nitrogen, phosphorus, sulfur, and ash depending upon species, size, and collecting site. For rigorous considerations of the elemental composition of fish in a body of water, fish of different species and sizes must be collected and analyzed. Nevertheless, for many ecological purposes the variation in elemental concentrations was not too large to prevent generalizations from data presented in this study. (Deal-EIS)
W79-05208

A MERCURY BUFFER FOR TOXICITY EXPERIMENTS WITH GREEN ALGAE,
Technische Hogeschool, Delft (Netherlands). Lab. of General and Technical Biology.
J. Huisman, and H. J. G. Ten Hoopen.
Water, Air and Soil Pollution, Vol. 10, No. 3, p 325-334. 1978. 4 fig, 4 tab, 6 ref.

Descriptors: Heavy metals, Chlorides, Chlorophyta, Chemical reactions, Reduction(Chemical), Evaporation, Growth rates, Chemical analysis, Chemical properties, *Buffers, *Mercury compounds, *MIDA, *Mercury, *Scenedesmus, *Toxicity.

Mercury (II) toxicity experiments with green algae are complicated by the fast reduction and evaporation of Hg. A Hg buffer system is described, which considerably stabilizes the Hg(II) concentration in test solutions. The Hg buffer consists of mercury(II) chloride and N-methyliminodiacetic acid(MIDA). Dissociation of Hg-MIDA complex compensates for loss of Hg. With this system experiments were performed with Hg(11) concentrations between 0.02 and 2.0 mg 1-1 at temperatures between 15 and 30C. No effect of MIDA on the growth of the green alga Scenedesmus acutus was detected. (Deal-EIS)
W79-05210

MODIFIED NEUSTON NET FOR COLLECTING LIVE LARVAL AND JUVENILE FISH,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
W. F. Hettler.
The Progressive Fish Culturist, Vol. 41, No. 1, p 32-33, 1979. 1 fig, 3 ref.

Descriptors: *Laboratory equipment, *Larval fish, *Juvenile stages, *Zooplankton, Fishing, Fishing gear, Fish collections, Methodology, Nueston sampler, Monitoring, *Sampling.

A nueston net has been used successfully at the Beaufort Laboratory to catch larval and juvenile fish for physiological and toxicological experiments. The collector has not been evaluated for net-induced mortality of captured organisms nor for its efficiency. Only few larval fish are impinged on the mesh. (Katz-EIS)
W79-05211

DEVELOPMENT OF A RAPID TISSUE BIOASSAY TECHNIQUE FOR SCREENING POLLUTANT EFFECTS ON FISH,
Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.
A. A. Friedman, and C. B. Coburn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 469, Price codes: A10 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee, Knoxville, Research Report No. 71, March 1979. 199 p, 37 fig, 5 tab, 39 ref, append. OWRT A-034-TENN(3), 14-34-0001-7090.

Descriptors: *Bioassay, Toxicity limits, *Pesticide toxicity, Liver, Fish physiology.

A rapid and relatively inexpensive tissue respirometric method for assessing the toxic effect of some classes of pollutants on fish has been developed and tested. It appears that fish liver homogenate respirometry is comparable with conventional fish bioassay with systemic toxicants other than those which primarily interfer with gas transfer mechanisms in the gill or are neurotoxicants. The response patterns of liver respirometry were similar in different species of fish and at different temperatures. Liver homogenates frozen in Krebs-Ringer's phosphate had a viability over six months when stored at -20C.
W79-05229

URBAN RAINFALL-RUNOFF-QUALITY DATA BASE,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 2A.
W79-05282

SYSTEMS FOR RAPID RANKING OF ENVIRONMENTAL POLLUTANTS. SELECTION OF SUBJECTS FOR SCIENTIFIC AND TECHNICAL ASSESSMENT REPORTS,
SRI International, Menlo Park, CA.
S. L. Brown, B. R. Holt, and K. E. McCaleb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 338, Price codes: A13 in paper copy, A01 in microfiche. EPA-600/5-78-012, Office of Health and Ecogical Effects, Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC., June 1978. 295 p, 2 fig, 17 tab, 84 ref, 9 appen.

Descriptors: *Environmental control, *Ranking, *Pollutants, Air pollution, Water quality, Contaminants, Assessment, Systems analysis, Ecology, Criteria, STAR, Priorities, Hazards, Cobalt, Carbon disulfide, Lithium, Beryllium, Plutonium, Heat, Cyanides, Carbonyl sulfide, Antimony, Molybdenum.

This document reports the results of the development and testing of a system for rapidly ranking environmental pollutants. One potential use for the system is in choosing the most important candidates for Scientific and Technical Assessment Reports (STAR). Of several possible approaches to ranking environmental agents, a system depending on expert opinion but assisted by an objective subsystem was selected for development. The system defines procedures for collecting, processing, and evaluating data on production and use; environmental transport, transformation, and rate; and human health and welfare and ecological effects. A test of the objective subsystem confirmed the utility of the system. Of ten candidate agents, the three highest ranked were cyanides, carbon disulfide, and beryllium. (Bell Graf-Cornell)
W79-05286

CONTROL OF OIL POLLUTION BY REMOTE SENSING ALONG THE SHORES OF FRANCE,
French Embassy, Washington, DC.
For primary bibliographic entry see Field 7B.
W79-05392

REMOTE SENSING FOR OIL POLLUTION CONTROL ALONG COASTAL WATERS OF THE UNITED STATES,
Coast Guard Research and Development Center, Groton, CT.
For primary bibliographic entry see Field 7B.
W79-05393

DETERMINATION OF CHLORIDE IN SULFITE PULP MILL EFFLUENTS (CHLORIDBESTIMMUNG IN SULFITZELLSTOFF-ABLAUGEN),
W. Kunstner, J. Hupfl, and S. Pfeiffer.
Das Papier, Vol. 32, No. 10, p 441-445, October, 1978. 3 illus, 3 ref, 2 tab. English summary.

Descriptors: *Sulfite liquors, *Chlorides, *Waste identification, Water analysis, Fuels, Pulp wastes, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Organic compounds, Ion exchange, Incineration, Oxygen, Volumetric analysis, Photometry, Analytical techniques, Pollutant identification.

Existing methods of chloride determination in sulfite pulp mill effluents or in fuels were refined to improve their accuracy. First, organic substances in the effluent must be removed, either by ion-exchange or by incineration in a stream of oxygen. Electrometric titration can follow in either case, but a photometric method using mercury thiocyanate may be substituted following the incineration procedure. Because of the very low chloride content and the high organic content of the effluents, deviations of 3-20%, depending on chloride content, must be expected. (Ward-IPC)
W79-05432

MEASUREMENT OF DISSOLVED OXYGEN,
RCA Lab. Ltd., Zurich (Switzerland).
M. L. Hitchman.
John Wiley and Sons, New York, N.Y. 1978. 255 p.

Descriptors: *Water analysis, *Dissolved oxygen, Analytical techniques, Polarographic analysis, Electrochemistry, Colorimetry, Manometers, Mass spectrometry, Thermodynamics, Gas chromatography, Oxygen, Solubility, Chemical analysis.

The eight chapters of this monograph discuss the need and importance of dissolved oxygen measurements, thermodynamic aspects, principles of voltammetry, membrane-covered polarographic detectors, electrochemical and chemical methods of dissolved oxygen determinations, including the Winkler method and its modifications, colorimetry, radiometry, and gas-phase measurements via manometry, volumetry, mass spectrometry, thermoconductivity, paramagnetism, and gas chromatography. Oxygen solubility tables, electrode potentials, convective flow and diffusion, and other useful appendices are included, along with a list of symbols used and a subject index. (Brown-IPC)
W79-05434

SOLUBLE ORGANIC CONSTITUENTS OF NATURAL WATERS AND WASTEWATERS BEFORE AND AFTER CHLORINATION,
North Texas State Univ., Denton. Inst. of Applied Sciences; and North Texas State Univ., Denton. Dept. of Chemistry.
W. H. Glaze, and G. R. Peyton.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H. Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 3-14, 1978 4 fig, 15 ref.

Descriptors: *Water pollution, *Chlorination, *Waste water treatment, Organic compounds, Analytical techniques.

The purpose of this paper was to report preliminary results which support the existence of intermediate molecular weight chlorine compounds in treated wastewater effluents and to present some details of an approach to the characterization of these species. The molecular weight profile of the water organics before and after chlorination was compared. Chlorination of a municipal treatment plant effluent with a high concentration of chlorine resulted in a peak representing a decrease in molecular weight of almost exactly one-half and a shoulder corresponding to molecules which are half the size of those comprising the main peak, showing that the addition of enough chlorine to produce a large residual results in the breakage of only a few bonds in the macromolecular backbone. Comparison of results using raw water with those from wastewater studies revealed that major components are found in raw water at the same molecular size as in wastewater. (See also W79-05435) (Chilton-ORNL)

W79-05436

PRECURSORS AND MECHANISMS OF HALOFORM FORMATION IN THE CHLORINATION OF WATER SUPPLIES,
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
J. C. Morris, and B. Baum.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L. Gorchev, H. and Hamilton, D.H. Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 29-48, 1978 12 fig, 4 tab, 8 ref. EPA R603231-02.

Descriptors: *Chlorination, *Water chemistry, Organic compounds, Water pollution, Public health, Freshwater, Chloroform, Environmental effects.

Representatives of pyrrolic-type compounds and of acetogenins were selected for study as potential precursors for formation of chloroform in water chlorination. Chlorine demand and chloroform yield were investigated as a function of time at varied pH values and different ratios of aqueous chlorine to organic compound. Results indicated two broad conclusions of general interest. First, a variety of organic substances likely to be present in natural waters may contribute to chloroform formation by way of the haloform reaction. Fulvates and humates are important precursors but not the only ones. Second, attention should be given to the total number of chlorine-carbon bonds produced and not only to chloroform produced. It was suggested that maintenance of hygenic quality of water with regard to hazards from chlorinated organic compounds will be best achieved by control of the total organic chlorine. (See also W79-05435) (Chilton-ORNL)
W79-05438

REACTIONS OF CHLORINE, CHLORINE DIOXIDE AND MIXTURES THEREOF WITH HUMIC ACID: AN INTERIM REPORT,
Olin Corp., New Haven, CT. Research and Development Center.
M. G. Noack, and R. L. Doerr.
In: Water Chlorination: Environmental Impact and Health Effects, Vol 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 49-58, 1978. 6 fig, 2 tab, 11 ref.

Descriptors: *Chlorination, *Water chemistry, Water treatment, Chlorine, Disinfectants, Oxidation, Potable water, Environmental effects.

This paper presents an interim report on research to define the chemistry of disinfecting drinking water with chlorine, chlorine dioxide and mixtures thereof in the presence of model humic acid. Investigations of kinetics and oxidant demand which plotted chlorine concentration vs. time in distilled water containing humic acid indicated the existence of no less than two simultaneous reactions distinguishable on the basis of overall order and rate. A fast chlorine demand was observed which increased with pH and the rate of the second-order reaction decreased. Ratios of fast ClO2/fast Cl2 demand at comparable pH values were roughly equal to the ratio of equivalent weights of ClO2/Cl2. In studies of formation of CHCl2 in reaction with Cl2, data suggested the existence of an intermediate product before the appearance of CHCl2. No significant pH effect was found on the formation of chlorite ion through reduction of ClO2. Study of the effect of mixtures of Cl2 and ClO2 showed that at pH 6.0 to 7.0 the chlorite ion was oxidized by chlorine to chlorate. It was concluded that at pH 6.0 to 7.0 a 1:1 mixture of chlorine and chlorine dioxide might be an alternative to water treatment with chlorine or chlorine alone. (See also W79-05435) (Chilton-ORNL)
W79-05439

AQUEOUS CHLORINATION PRODUCTS OF POLYNUCLEAR AROMATIC HYDROCARBONS,
Minnesota Univ., Duluth. Dept. of Chemistry.
R. M. Carlson, R. Caple, A. R. Oyler, K. J. Welch, and D. L. Bodenner.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 59-65, 1978 1 fig, 1 tab, 14 ref. EPA R 803952.

Descriptors: *Chlorination, *Water chemistry, PAH, Potable water, Hydrogen ion concentration, Oxidation.

The purpose of this research was to identify the reaction products of the aqueous chlorination of selected polynuclear aromatic hydrocarbons (PAHs) including some found in drinking water. Reactions were conducted under varying conditions of time, chlorine dosage and pH as might be encountered during actual treatment. Experimental results showed that extent of conversion of PAHs to secondary products was related to pH with greater acidity resulting in greater conversion. With the exception of formation of anthraquinone upon chlorination of anthracene, the oxidation products whose structures were determined had chlorine incorporated into the aromatic nucleus. During analysis of chlorination products of fluoranthene, the initial reverse-phase HPLC separation indicated a polar derivative but subsequent GC/MS analysis indicated a more lipophilic monochlorosubstitution product. The initial formation of a chlorohydrin is suggested as explanation of these conflicting observations. (See also W79-05435) (Chilton-ORNL)
W79-05440

REACTIONS IN CHLORINATED SEAWATER,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
J. H. Carpenter, and C. A. Smith.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 195-207, 1978 7 fig, 15 ref. EPA R803893 & ERDA AT (40-1)-3801.

Descriptors: *Chlorination, *Water chemistry, Organic compounds, Sea water, Halogens, Copper, Toxicity, Environmental effects, Water pollution.

This paper discusses the chemistry of chlorinated sea water in terms of residual oxidants, bromate formation, formation of halogenated organic compounds and the modification of copper complexing capacity. Techniques for the analysis of residual oxidants in chlorinated sea water are presented. Sunlight exposure of chlorinated sea water produced substantial conversion of the oxidative capacity in added chlorine to bromate ion. Significance of this bromate formation in producing direct toxicity or the slow formation of halogenated organic compounds is uncertain. Bromoform and, to a lesser extent, chlorodibromomethane are identified as the most obvious organic products of chlorination of sea water. Reactions are oxidant-limited. At 1 and 2 ppm chlorine addition levels, the residual oxidants drop rapidly with a corresponding increase in bromoform. Calculations show that bromoform formation is not a first-order reaction. Experimental results indicated that chlorine addition has the potential for modifying the organic compounds that nearly completely complex copper in natural waters and increase the toxicity of the copper presence. (See also W79-05435) (Chilton-ORNL)
W79-05450

CHLORINE DEGRADATION AND HALOCARBON PRODUCTION IN ESTUARINE WATERS,
Maryland Univ., College Park. Dept. of Chemistry.
G. R. Helz, R. Sugam, and R. Y. Hsu.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 209-222, 1978. 4 fig, 2 tab, 14 ref. EPA R 803839-01/02.

Descriptors: *Chlorination, *Water pollution, *Water chemistry, Sea water, Estuaries, Discharge(Water), Chlorine, Cooling water, Chemical degradation.

This paper deals with the chemical processes which create chlorine demand and control chlorine decay in estuarine waters. Field observations show that 90% of oxidant dose disappears by the time cooling water emerges from the plant. This large oxidant loss observed in the discharge canal was not seen under laboratory conditions. A slow decay phase was seen to follow the fast decay phase with the slow decay rate being slightly faster in daytime than nighttime. No free chlorine was ever detected in the canal. Only traces of haloforms were found in discharge waters. Ammonia nitrogen increased from intake canal to terminus of discharge canal. Chlorine decay processes are discussed in some detail and attempts are made to provide interpretation of the indicated field observations. (See also W79-05435) (Chilton-ORNL)
W79-05451

INVESTIGATION OF HALOGENATED COMPONENTS FORMED FROM CHLORINATION OF MARINE WATER,
Batelle Pacific Northwest Lab., Richland, WA.
R. M. Bean, R. G. Riley, and P. W. Ryan.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 223-233, 1978. 2 fig, 2 tab, 8 ref.

Descriptors: *Chlorination, *Water chemistry, Water pollution, Halogens, Analytical techniques, Sea water.

This paper reports a study which investigates the formation of nonpolar, presumably lipophilic organohalogens in sea water. Gas chromatographic analysis techniques are discussed. Analysis of extracts obtained from the forcing of sea water through XAD-2 resin columns showed the principal component in all sea water samples to be bromoform. Smaller quantities of dibromochloromethane and traces of dichlorobromomethane were found. Chloroform was not present in significant concentration. On the basis of results obtained so far, it was concluded that concentrations of nonpolar and presumably lipophilic components generated by low-level chlorination of relatively pristine sea water are low. (See also W79-05435) (Chilton-ORNL)
W79-05452

THE EFFECT OF AMMONIA CONCENTRATION ON THE CHEMISTRY OF CHLORINATED SEA WATER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
G. W. Inman, Jr., and J. D. Johnson.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 235-252, 1978. 8 fig, 1 tab, 19 ref. NRC-04-77-119.

Descriptors: *Chlorination, *Water chemistry, Water pollution, Sea water, Ammonia, Nitrogen, Bromides.

The primary purpose was to determine the critical ammonia-to-bromide ratio where monochloramine formation begins to predominate over bromamine formation. Experimental results showed that a mixture of dibromamine and monochloramine will form in full-strength chlorinated sea water when the ammonia nitrogen is greater than 0.5 mg/l and the chlorine dose is less than 2.5 mg/l. At higher ammonia concentration and longer times, monochloramine becomes the major component of the total oxidant concentration. The critical weight ratio of ammonia nitrogen: bromide was found to be approximately 0.008 at pH 8.1. At higher ratios, monochloramine predominates after 30 minutes to 1 hour and, at lower ratios, the oxidant concentration consists of dibromamine with a small fraction

of the total oxidant being monochloramine. (See also W79-05435) (Chilton-ORNL)
W79-05453

MICROBIAL DEGRADATION OF HALOGENATED HYDROCARBONS,
Texas Univ. at Austin. Dept. of Microbiology.
A. W. Bourquin, and D. T. Gibson.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 253-264, 1978. 3 fig, 3 tab, 21 ref. EPA R 804525.

Descriptors: *Chlorination, *Water chemistry, Water pollution, Halogens, Sea water, Microbial degradation.

Biochemical and soil microbiology studies reported in this paper indicate that numerous mechanism exist for the dehalogenation of both aliphatic and aromatic hydrocarbons. The existence of enzymatic systems capable of dehalogenation is shown. It is pointed out that the existence of organisms in the marine environment capable of such biodegradation is as yet undetermined but it seems feasible to assume that the same type reactions could occur in the marine environment as in the terrestrial environment. (See also W79-05435) (Chilton-ORNL)
W79-05454

OPTIMIZING TRIHALOMETHANE ANALYSIS,
Montgomery (James M.) Inc., Pasadena, CA. Environmental Research Lab.
A. R. Trussell, M. D. Umphres, L. Y. C. Leong, and R. R. Trussell.
In: Water Chlorination: Environmental Impact and Health Effects, Vol 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 543-553. 1978. 1 fig, 4 tab, 13 ref.

Descriptors: *Water chemistry, *Analytical techniques, Chlorination, Water quality.

This study reports on liquid-liquid extraction (LLE) technique for the analysis of trihalomethanes. The technique is approached systematically to overcome difficulties associated with the method in the past. Quality assurance is enhanced by the high resolution of glass capillary gas chromatography. It is suggested that further research is needed to further define the best conditions for sample preservations, extraction and specific detention. It was concluded that the proven success and simplicity of LLE make it the most promising routine analytical technique at the present time. (See also W79-05435) (Chilton-ORNL)
W79-05476

MEASUREMENT AND SIGNIFICANCE OF SPECIFIC ACTIVITY IN THE HETEROTROPHIC BACTERIA OF NATURAL WATERS,
Gordon Coll., Wenham, MA. Dept. of Biology.
R. T. Wright.
Applied and Environmental Microbiology, Vol. 36, No. 2, August 1978, p 297-305. 6 fig, 3 tab, 31 ref. NSF DES 73-6650 & OCE 77-19446.

Descriptors: *Bacteria, *Heterotrophy, *Specific activity, *Measurement, *Counting, *Methodology, *Analytical techniques, *Estuarine environments, Staining, Acridine orange direct count, Epifluorescence, Radioisotopes, Massachusetts, Estuaries, Coasts, Atlantic Ocean, Oceans, Degradation(Decomposition), Metabolism, Physiology, Specific activity indices, Tracers, Indicators, Filters, Habitats, Nutrients.

A 'specific activity index' which expresses the relationship between heterotrophic bacterial activity and the bacteria responsible for that activity, combines accurate total counts of bacteria (using the acridine orange direct count (AODC) and epifluorescence microscopy) and three highly sensitive measures of heterotrophic activity using radiosotopes. The three indices--(1) V sub max kinetic approach, (2) turnover rate-tracer approach, and (3) direct uptake measurement approach--all utilize direct bacterial count as the denominator, but have different numerators, each of which has been shown to vary directly with heterotrophic bacterial activity. The combined approach is illustrated with data from estuarine and coastal waters of northeastern Massachusetts, which show major differences in specific activity accompanying habitat differences, such as distance offshore or into an estuary, or vertical location in the water column. Data suggest that specific activity is a valid indicator of the physiological state and metabolic role of the bacteria. Some evidence shows that natural bacteria are adapted to conditions of nutrient starvation by becoming dormant, existing for an unknown period of time in a reversible physiological state reflecting organic nutrient availability. (Lynch-Wisconsin)
W79-05490

A RAPID ESTIMATION OF 5-DAY BOD OF SPENT SULFITE LIQUOR,
Quebec Univ., Trois Rivieres (Quebec). Pulp and Paper Research Center.
J. J. Garceau, and S. N. Lo.
Tappi, Vol. 61, No. 12, p 85-86, December 1978. 2 fig, 12 ref, 1 tab.

Descriptors: *Sulfite liquors, *Biochemical oxygen demand, Sulfite pulp mills, Wastes, Industrial wastes, Pulp wastes, Pulp and paper industry, Effluents, Water pollution sources, Carbohydrates, Analytical techniques, Water pollution control, Biological treatment, Glucose, Spent sulfite liquor, Water analysis.

Studies showed that the standard 5-day BOD of spent sulfite liquor (SSL) samples (200-15,000 mg/liter) correlates linearly with the total carbohydrate values, reported as apparent glucose (determined with an anthrone reagent). Based on a measured 5-day BOD of 6700 mg/liter and at 95% confidence, 5-day BOD can be predicted with the anthrone reagent within plus or minus 26% in 30 min. The total carbohydrate value is thus recommended for potential use to estimate 5-day BOD and to control the biological treatment of SSL. (Swichtenberg-IPC)
W79-05500

5B. Sources Of Pollution

DEVELOPMENT AND EVALUATION OF A TWO-STEP MEMBRANE FILTER METHOD FOR FECAL COLIFORM RECOVERY IN CHLORINATED SEWAGE EFFLUENTS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5A.
W79-05012

THE SEYMOUR AQUIFER GROUND-WATER QUALITY AND AVAILABILITY IN HASKELL AND KNOX COUNTIES, TEXAS, VOLUME I.
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W79-05014

THE SEYMOUR AQUIFER GROUND-WATER QUALITY AND AVAILABILITY IN HASKELL AND KNOX COUNTIES, TEXAS, VOLUME II.
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-05015

A FINITE ELEMENT METHOD FOR THE DIFFUSION-CONVECTION EQUATION WITH CONSTANT COEFFICIENTS,
British Columbia Univ., Vancouver. Faculty of Graduate Studies.
E. Varoglu, and W. D. L. Finn.
Advances in Water Resources, Vol. 1, No. 6, p 337-343, December 1978. 10 fig, 1 tab, 20 ref.

Descriptors: *Dispersion, *Diffusion, *Convection, *Model studies, Mathematical models, Finite element analysis, Equations, Pollutants, Path of pollutants, Water pollution, Air pollution, Analytical techniques.

Existing numerical methods for the solution of the diffusion-convection equation are unsatisfactory for convection dominated flow problems. A new finite element method incorporating the method of characteristics for the solution of the diffusion-convection equation with constant coefficients in one spatial dimensions was derived. This method is capable of solving the diffusion-convection equation without any of the difficulties encountered in the existing numerical methods for the whole spectrum of dispersion from pure diffusion, through mixed dispersion, to pure convection. Several examples for the one-dimensional case were solved, and results were compared with the exact solutions. The generalization of the method to variable coefficients and to the diffusion-convection equation in two space dimensions was discussed. (Sims-ISWS)
W79-05019

AN EVENT-BASED STOCHASTIC MODEL OF PHOSPHORUS LOADING INTO A LAKE,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering and Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
L. Duckstein, I. Bogardi, and M. Fogel.
Advances in Water Resources, Vol. 1, No. 6, p 321-329, December 1978. 7 fig, 4 tab, 50 ref. NSF GF-38183.

Descriptors: *Water pollution, *Lakes, *Phosphorus, *Model studies, Mathematical models, Stochastic processes, Simulation analysis, Numerical analysis, Probability, Rainfall, Precipitation(Atmospheric), Runoff, Seasonal, Sediments, Watersheds(Basins), Pollutants, Path of pollutants, *Lake Balaton(Hungary).

In most lakes, phosphorus (P) is the nutrient controlling the trophic state. Thus, for effective control of eutrophication, the uncertainty in P-loading should be encoded as a probability density function (pdf). Specifically, the pdf of P-loading Y from non-point agricultural sources was sought by means of an event-based stochastic model. P-loading events were triggered by precipitation events (X sub 1, X sub 2, T), in which X sub 1 was the rainfall amount, X sub 2 the duration, and T the interarrival time between events. (X sub 1, X sub 2) were dependent random variables, while T was assumed to be exponentially distributed. The precipitation event causes runoff, which carries dissolved P into the lake with a concentration C sub 1 and sediment yield, Z, which carries fixed or sorbed P into the lake in a fraction C sub 2 of Z. Seasonal loading of P was calculated by adding random numbers of random variables. The model accounted separately for dissolved P and sorbed P. Explicit expressions were given for the mean and variance of each type of P-loadings. The case study of a sub-watershed of Lake Balaton, Hungary, was used to illustrate the methodology. Precipitation data, empirical rainfall--runoff--sediment yield relationships, and a small number of observations of events were used to calibrate the model and to estimate the means and variances of loading per event and per season. Then, a simulation method was used to estimate complete pdf of these random variables. Use of the model for alternative methods of controlling P-loading was discussed briefly, as well as the economics of control. (Sims-ISWS
W79-05021

RADIAL DISPERSION TO AN ABSTRACTION WELL,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W79-05027

FINITE-DIFFERENCE SOLUTIONS FOR ONE-DIMENSIONAL DISPERSION USING AN IMPROVED MESH DESIGN,
Birmingham Uni. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W79-05028

DRAINAGE DENSITY AT INDEX OF WATERSHED DEVELOPMENT,
Rice Univ., Houston, TX. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 4A.
W79-05034

WASHOFF OF HERBICIDES APPLIED TO CORN RESIDUE,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
C. D. Martin, J. L. Baker, D. C. Erbach, and H. P. Johnson.
Transactions of the American Society of Agricultural Engineers, Vol. 21, No. 6, p 1164-1168, November-December 1978. 5 fig, 4 tab, 7 ref.

Descriptors: *Herbicides, *Runoff, *Water pollution sources, Laboratory tests, Simulated rainfall, Pollutants, Path of pollutants, Corn, Crops, Weed control, Water pollution, Agriculture, *Herbicide washoff, Corn residue.

In a laboratory study, herbicides, cyanazine, alachlor, atrazine, and propachlor were applied (0.4 and 1.8 kg/ha) to corn residue, which in turn was subjected to simulated rainfall. Concentrations and amounts of herbicides washing off with time were measured. Concentrations in initial washoff water were high for all herbicides (greater than 9 ppm for the high application rate). Concentrations decreased rapidly with time; approximately the same amount washed off with the first 0.5 cm of water as did with the next 3.0 cm of water. Mass balances of the applied herbicides showed that most of the herbicide washed off; little was retained by the corn residue with the exception of cyanazine. Unexplained losses of the other herbicides indicated the possibility of volatilization occurring between application of herbicides and application of washoff water about 12 h later. (Sims-ISWS)
W79-05036

SURFACE RUNOFF FROM SLUDGE-AMENDED SOILS,
Purdue Univ. Lafayette, IN. Dept. of Agronomy.
E. J. Kladivko, and D. W. Nelson.
Journal of the Water Pollution Control Federation, Vol. 51, No. 1, p 100-110, January 1979. 1 fig, 7 tab, 30 ref.

Descriptors: *Sewage sludge, *Sludge disposal, *Surface runoff, Nutrients, Heavy metals, Water quality, Water pollution, Laboratory tests, Erosion, Sediments, Soils, Soil types, Loam, Nitrogen, Phosphorus, Carbon, Hydrogen ion concentration, Zinc, Copper, Lead, Nickel, Cadmium, Pollutants, Path of pollutants, Agriculture, Incorporation methods.

Liquid, anaerobically digested wastewater sludge was applied to a moderately well-drained silt loam soil at rates of 22.4, 56, and 89.6 metric tons per hectare and to a poorly drained silt loam and a well-drained sandy loam at a rate of 56 metric tons per hectare. After drying, the sludge was either incorporated into the soil by rototilling or disking or allowed to remain intact on the surface. Soil cores 0- to 15-cm deep were collected from the plots 2.5 months after sludge addition and subjected to a 5.72-cm/h rainstorm by a laboratory rainfall simulator. Runoff water and sediments were collected, weighed, and analyzed for phosphorus and nitrogen components; sediment, nutrient, and metal losses were assessed. (Sims-ISWS)
W79-05041

SYSTEMATIC DIURNAL CURVE ANALYSIS,
Hickok (Eugene A.) Associates, Wayzata, MN.
J. B. Erdmann.
Journal of the Water Pollution Control Federation, Vol. 51, No. 1, p 78-86, January 1979. 8 fig, 1 tab, 16 ref, 1 append.

Descriptors: *Water quality, *Dissolved oxygen, *Rivers, *Model studies, Mathematical models, Diurnal, Variability, Respiration, Biochemical oxygen demand, Photosynthesis, Oxygen, Water pollution, Pollutants, Computer models, Simulation analysis, *Charles River(MA).

Systematic diurnal curve analysis is an adaptation of the diurnal curve method for determining photosynthesis and respiration rates in rivers, based on dissolved oxygen measurements and hydraulic data. The new technique utilizes the Stokes total time derivative and, consequently, is valid even where time of flow between two stations exceeds one day. It is computerized; therefore, the technique can treat sets of dissolved oxygen measurements from many stations along a river taken over several days. The technique was applied to data from the Charles River in Massachusetts. Estimates of daily average photosynthesis and respiration ranged as high as 12.0 mg 02 per litre and 36.2 mg 02 per litre, respectively. The estimates were used to simulate average dissolved oxygen. The ratio of photosynthesis:respiration ranged from 0.32 to 0.96 in the down-stream direction. Photosynthesis was observed to be approximately double the magnitude of the diurnal dissolved oxygen range. Respiration exhibited a linear relationship with 5-day biochemical oxygen demand. (Sims-ISWS)
W79-05042

A GEOGRAPHICALLY VARIABLE WATER QUALITY INDEX USED IN OREGON,
Oregon State Dept. of Environmental Quality, Salem. Water Quality Div.
D. A. Dunnette.
Journal of the Water Pollution Control Federation, Vol. 51, No. 1, p 53-61, January 1979. 7 fig, 4 tab, 23 ref.

Descriptors: *Water quality, *Streams, *Rivers, *Oregon, Sampling, Variability, Model studies, Mathematical models, Watersheds(Basins), Water pollution, Pollutants, Suspended solids, Dissolved solids, Turbidity, Heavy metals, Dissolved oxygen, Coliforms, Hydrogen ion concentration, Biochemical oxygen demand, Planning, *Willamette River(OR), Water quality criteria, Indexes, Seasonal variations.

An Oregon Water Quality Index has been developed which takes into account differences in water quality resulting from geographical characteristics of separate basins. The index was developed for the purpose of providing a simple, concise, and valid method for expressing the significance of regularly generated laboratory data. The trend-monitoring value of the index was demonstrated for two quite different Willamette River stations. Correlations among this and several other proposed indexes averaged 0.87. Yearly and seasonal variations in water quality were quantitized and found to average 88.9 and 78.9 Oregon Water Quality Index units for the higher and lower water quality stations, respectively, over the period 1971-1976. Calculated rates of change in water quality were +0.68 and +0.91 Oregon Water Quality Index units/year for the two stations for 1971-1976. The Oregon Water Quality Index is now used routinely in Oregon's primary station sampling program to recognize water quality trends. (Sims-ISWS)
W79-05043

FATE OF METAL IONS DURING DOMESTIC TREATMENT OF WATER CONTAINING ORGANICS,
New Hampshire Univ., Durham. Dept. of Chemistry.
For primary bibliographic entry see Field 5F.
W79-05046

MOVEMENT OF PESTICIDES AND NUTRIENTS WITH WATER AND SEDIMENT AS AFFECTED BY TILLAGE PRACTICES: A FIELD STUDY,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. L. Baker, and H. P. Johnson.
Iowa State Water Resources Research Institute, Iowa State University, Completion Report, March 1978. 91 p, 4 fig, 7 tab, 3 append. OWRT A-050-IA(1), 14-31-001-5015.

Descriptors: *Pesticide kinetics, *Nutrients, *Surface runoff, Herbicides, Insecticides, Soil erosion, Triazine pesticides, Pesticide movement, Nitrigen, Phosphorus, *Tillage, Alachlor, Atrazine, Cyanazine, Fonofos, Ridge-plant, Till-plant.

Two conservation tillage systems were studied and compared with the conventional (plow-disk-plant) tillage system. Runoff, soil loss, nutrient losses, and pesticide losses during the 1972-75 growing seasons were measured for six small paired watersheds planted to continuous corn. The ridge-plant system had over 50% of the surface covered with residue, the till-plant system 11%, and conventional system less than 2%. Conservation tillage systems on the average reduced runoff about 40% and reduced soil loss 60 to 90%. Total losses of nitrogen and phosphorus (total P in sediment measured only in 1973) were mostly associated with soil loss and consequently were decreased for conservation tillage systems. Solution phosphorus losses and concentrations and available P concentrations in sediment (measured in 1974 and 1975) increased with residue cover. Fonofos, atrazine, alachlor, and cyanazine losses on the average were reduced by conservation tillage, although pesticide concentrations in sediment and/or water were sometimes higher. About one-half of the average fonofos losses were with water, whereas from 80 to 90% of the average herbicide losses were with water.
W79-05050

NONPOINT SOURCE POLLUTION FROM COASTAL PLAIN SOILS IN DELAWARE,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
W. F. Ritter, R. P. Eastburn, and J. P. Jones.
Paper No. 78-2046, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 26 p, 6 fig, 11 tab, 14 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Nutrient removal, Runoff, *Surface runoff, Return flow, Pollutants, Agricultural watersheds, Rainfall, Delaware, *Nonpoint pollution.

Nitrogen, phosphorus and organic matter were monitored on four agricultural watersheds in the Delaware Coastal Plain. Total nitrogen and total phosphorus loads in runoff and baseflow were less than the nitrogen and phosphorus loads in rainfall. (Skogerboe-Colorado State)
W79-05065

DETECTION OF ENTEROVIRUSES AND BACTERIAL PATHOGENS SURVIVING STANDARD SEWAGE TREATMENT,
Maryland Univ., College Park. Dept. of Microbiology.
F. M. Hetrick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 209, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Maryland, Technical Report No. 53, January 1979. 35 p, 7 fig, 5 tab, 30 ref. OWRT A-035-MD(1) and A-036-MD(1). 14-34-0001-6021.

Descriptors: Ultrafiltration, *Viruses, Sewage effluents, *Pathogens, *Coliforms, Shigella, Salmonella, Klebsiella, Proteus.

A commercially available dialysis unit, the Amicon DC-30 Diaflo unit, was evaluated for its utility in concentrating enteric viruses and bacteria from the effluents of a sewage treatment plant. The unit's efficiency for virus recovery was evaluated by seeding tap water samples with enteroviruses and then refining the concentration procedure so that acceptable virus recovery (>25%) was attained.

However, many difficulties were encountered when sewage effluents were examined, most notably the poor flow rates and the poor virus recovery. The particulate matter present in the effluent apparently adsorbs much of the virus that is present which is then removed with the suspended solids as the sample passes through the unit. The bacterial quality of the effluents was surprisingly good with coliform counts of some samples meeting recreational water standards, however, Shigella, Salmonella, Klebsiella, and Proteus species were occasionally isolated from the effluents. Major conclusions are (a) the Amicon DC-30 unit has only limited application for the concentration of enteroviruses from sewage effluents due to poor virus recovery rates and (b) the occasional isolation of viruses and pathogenic bacteria from the effluents indicates that some pathogens survive secondary sewage treatment.
W79-05090

PRELIMINARY RESULTS CONCERNING EFFECTS OF CHLORINE ON MONOSPECIFIC MARINE PHYTOPLANKTON,
Universite de Bretagne-Occidentale, Brest (France). Lab. de Physiologie Vegetale.
C. Videau, M. Khalanski, and M. Penot.
Journal of Experimental Marine Biology and Ecology, Vol 36, p 111-123, 1979. 6 fig, 4 tab, 24 ref.

Descriptors: *Chlorine, *Phytoplankton, *Toxicity, *Chlorophyta, Chlorination, Cytological studies, Mortality, Marine algal, Growth rates, Photosynthesis, Chlorophyll, Productivity, *Dunaliella, *Pavlora, *Phaeodactylum.

Static chlorination tests have been carried out on three phytoplanktonic marine species, Dunaliella primolecta, Pavlova lutheri, Phaeodactylum tricornutum. These tests have led to the following conclusions. (1) The specific response and the sensibility threshold of the algae tested: the chlorine LD 50 for the least dense culture (10 to the third power cells.ml-1) of Dunaliella and Pavlova is 0.4 and 4.0 ppm respectively, while the growth of Phaeodactylum is reduced or ceases at a chlorine concentration of 0.6 ppm. (2) Influence of cellular density: chlorine toxicity increases with decreasing cellular concentration (tests from 1000 to 10 to the sixth power cells.ml-1). (3) The effect on chlorophyll a concentration is not affected when the morality due to the chlorine injection is <50%; the chlorophyll a concentration is greatly reduced for higher mortality. (4) Influence of light: chlorinations conducted in the dark produce a lower mortality, for Dunaliella, than chlorinations conducted in the light; the mortality is lower as long as the cultures are kept in the dark. (Deal-EIS)
W79-05093

PREDICTING EFFECTS OF COLD SHOCK: MODELING THE DECLINE OF A THERMAL PLUME,
Battelle Pacific Northwest Labs., Richland, WA. Ecosystems Dept.
C. D. Becker, D. S. Trent, and M. J. Schneider.
Available from the National Technical Information Service, Springfield, VA 22161 as PNL-2411, Price codes: A03 in paper copy, A01 in microfiche. Battelle, Pacific Northwest Laboratories Publication No PNL-2411, 32 p, 1977. 12 fig, 24 ref.

Descriptors: *Water temperature, *Cold resistance, *Thermal pollution, *Thermal stress, Adaptation, Powerplants, Outlets, Fish physiology, Animal metabolism, Heated water, Thermal powerplants, Sockeye salmon, Shiners, Bullheads, Fishkills, Mathematical models, *Poikilotherms.

Predicting direct impact of cold shock on aquatic organisms after termination of power plant thermal discharges requires thermal tests that provide quantitative data on the resistance of acclimated species to lower temperatures. Selected examples from the literature on cold shock resistance of freshwater and marine fishes are illustrated to show predictive use. Abrupt cold shock data may be applied to field situations involving either abrupt or gradual temperature declines, but yield conservative estimates under the latter conditions. Gradual cold shock data may be applied where heated plumes gradually dissipate because poikilotherms partially compensate for lowering temperature regimes. A simplified analytical model is presented for estimating thermal declines in terminated plumes originating from offshore, submerged discharges where shear current and boundary effects are minimal. When applied to site-specific conditions, the method provides time-temperature distributions for correlation with cold resistance data and, therefore, aids in assessing cold shock impact on aquatic biota. (Deal-EIS)
W79-05094

TOXICITY OF PHOSSY WATER TO SELECTED FRESHWATER ORGANISMS,
Army Armament Research and Development Command, Aberdeen Proving Ground, MD. Chemical Systems Lab.
J. G. Pearson, P. F. Robinson, and E. S. Bender.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-054 374, Price codes: A02 in paper copy, A01 in microfiche. Aberdeen Proving Ground Report No. ARCSL-TR-78024, 21 p, 1978. 1 fig, 10 tab, 11 ref.

Descriptors: *Phosphorus, *Toxicity, *Bioassay, Lethal limit, Mortality, Explosives, Chemical wastes, Sunfishes, Livebearers, Invertebrates, Water chemistry, Water analysis, Shrimp, Worms, Insects, Phosphates, *Mosquito fish, *Phossy water, Pine Bluff Arsenal, Pine Bluff, Arkansas.

Six species of freshwater organisms were exposed to the wastewater from a white phosphorus munitions filling facility, Pine Bluff Arsenal, Pine Bluff, Arkansas, in toxicity tests. Both fish (Gambusia affinis and Lepomis macrochirus) and benthic macroinvertebrates (Clyptotendipes sp., Palaemonetes kadiakensis, Chaoborous punctipennis, and Branchiura sowerbyi), endemic to the area, were tested for periods of up to 96 hours. The median effective concentration (EC50) for all the invertebrates was between the LC50 for the bluegill (L. macrochirus 29.0 micrograms/1 P4) and the mosquito fish (G. affinis, 75 micrograms/1 P4). (Deal-EIS)
W79-05095

TRACE METAL CONTAMINATION OF THE ROCK SCALLOP, HINNITES GIGANTEUS, NEAR A LARGE SOUTHERN CALIFORNIA MUNICIPAL OUTFALL,
Southern California Coastal Water Research Project, El Segundo.
D. R. Young, and T-K. Jan.
Fishery Bulletin, Vol. 76, No. 4, p. 936-939, 1979. 1 fig, 2 tab, 12 ref.

Descriptors: *Heavy metals, *Municipal wastes, *Absorption, Chemical analysis, Animal physiology, Animal metabolism, Cadmium, Chromium, Copper, Mercury, Zinc, Lead, Nickel, Outlets, Path of pollutants, Bottom sediments, Water chemistry, Primary treatment, Sewage effluents, Los Angeles County, *Scallops, *Tissue analysis, *Bioaccumulation, *Silver.

The data presented indicate that the submarine injection of primary-treated municipal wastewater can lead to distinct trace metal contamination of filter-feeding rock scallops within a few kilometers of the discharge. Mean values for silver, cadmium, chromium, copper, mercury, and zinc in gonadal and/or muscle tissue of specimens collected near the Los Angeles County outfalls ranged from approximately 2 to 23 times the corresponding means for control specimens. These elevations do not appear to be artifacts caused by contamination from particulates in the digestive gland, but rather to result from actual physiological uptake of the metals. Although the results of this study point to a potential problem from waste metals discharged via municipal outfalls, we do not yet know the degree to which such elevated metals affect the rock scallop or its predators. (Deal-EIS)
W79-05096

THE NATURE OF METALS-SEDIMENT-WATER INTERACTIONS IN FRESHWATER BODIES, WITH EMPHASIS ON THE ROLE OF ORGANIC MATTER,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Petroleum Exploration Branch.
For primary bibliographic entry see Field 5A.
W79-05106

AN EVALUATION OF THE STATUS, LIFE HISTORY, AND HABITAT REQUIREMENTS OF THE ENDANGERED AND THREATENED FISHES OF THE UPPER COLORADO RIVER SYSTEM. PART TWO,
Ecology Consultants, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 5A.
W79-05114

MESA NEW YORK LIGHT PROJECT ANNUAL REPORT FOR FISCAL YEAR 1977.
National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.
NOAA/ERL Marine Ecosystems Analysis Program Report October 1978. 142 p, 8 fig, 3 tab, 2 plate, 4 append.

Descriptors: *Water quality, *Water pollution effects, *Waste disposal, Oil pollution, Research facilities, New York, *New York Bight, Annual reports.

The annual report for fiscal year 1977 presents an overview of MESA New York Bight Project activities between October 1, 1976 and September 30, 1977. The research results of the Project, focused on specific environmental issues, are highlighted under the following topics: contaminants of the New York Bight, New York Bight anoxia of 1976, sewage sludge dumping, and dredge spoil dumping. A bibliography lists the publications resulting from work supported by the New York Bight Project, and publications of the Project itself. (NOAA)
W79-05116

CHARACTERISTICS OF THE OSWEGO RIVER PLUME AND ITS INFLUENCE ON THE NEARSHORE ENVIRONMENT,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2E.
W79-05118

GROUND-WATER POLLUTION--A STATUS REPORT,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 5C.
W79-05120

GROUND-WATER POLLUTION--AN IMMINENT DISASTER,
Ohio State Univ., Columbus. Dept. of Geology and Mineralogy.
For primary bibliographic entry see Field 5C.
W79-05121

GROUND-WATER POLLUTION--A LIMITED PROBLEM,
Dunn Geoscience Corp., Latham, NY.
D. T. Clark.
Ground Water, Vol. 17, No. 1, p 25-27, January-February 1979.

Descriptors: *Groundwater, *Water pollution, *Water pollution sources, *Path of pollutants, Landfills, Leaching, Waste disposal, Chemicals, Sampling, Monitoring, Water supply, Groundwater movement, Pollutant identification.

Few would argue that groundwater pollution is a problem and that serious groundwater pollution problems do exist. As serious as some isolated groundwater pollution problems are, regionally and nationally, it is only a limited problem. An industrial landfill may result in a leachate plume

contaminating groundwater over an area of up to several square miles downgradient from the disposal site. Municipal landfills or chemical/petroleum spills can result in polluted groundwater over areas measured in square miles. Surrounding these areas of groundwater pollution, however, are tens and hundreds of square miles of area where the groundwater moving through the aquifers maintains its natural good quality. The ratio of good quality to contaminated water is such that groundwater pollution can really only be considered as a limited problem. The problem will most likely remain limited as existing and future regulations continue to restrict the poor disposal practices that have been responsible for much of the past and existing pollution problems. Technology has advanced to the point that with proper management and sound governmental regulations, control, isolation, and cleanup of contamination sources and areas of polluted groundwater can be so effective that migration of the pollution front can be stopped and actually reversed with time. (Sims-ISWS)
W79-05122

GROUND-WATER QUALITY STANDARDS--A NEUTRAL VIEW,
Michigan Dept. of Public Health, Lansing.
D. K. Keech.
Ground Water, Vol. 17, No. 1, p 30-34, January-February 1979.

Descriptors: *Groundwater, *Water pollution, *Water quality, *Water quality standards, *Michigan, Pollutants, Path of pollutants, Waste disposal, Irrigation, Industries, Chemicals, Monitoring, Sampling, Aquifers, Leaching, Landfills, Water resources, Hydrogeology.

An objective view of the need for groundwater quality standards requires that an individual recognize the value that groundwater contributes to the water supply needs of our nation. A vast number of people living in rural areas and a large number of communities are dependent upon groundwater as their sole source of water for domestic, industrial, commercial, and agricultural needs. This large use and dependency upon groundwater dictates that these resources are valuable and must be protected for both present day and future uses. There are many examples where present methods of disposal of wastes generated in America have not been satisfactory from an environmental standpoint, with an exception of projects where disposal sites have been properly designed, operated, and managed for protection of the groundwater. One possible solution for groundwater protection is the establishment of groundwater quality standards. The purpose of such standards is to protect the public health and welfare and to maintain the quality of groundwaters in all usable aquifers for individual, public, industrial, and agricultural water supplies. A legal basis must exist and the prescribed steps must be followed as dictated by the rule making process. The primary aim of such standards is to prevent the degradation of groundwaters such as they will not become a public health hazard or harm the users of the groundwater. (Sims-ISWS)
W79-05123

GROUND-WATER QUALITY STANDARDS--RELEVANT,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
J. H. McDermott.
Ground Water, Vol. 17, No. 1, p 35-38, January-February 1979.

Descriptors: *Water quality, *Water quality standards, *Groundwater, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Sampling, Monitoring, Waste disposal, Aquifers, Water supply, Hydrogeology, Regulation.

The opportunity to begin formulating a national groundwater quality protection program is at hand. In building the new program, we should use the host of lessons learned in the experience of related environmental programs. This is necessary so that the new program will be realistic at the outset and congruent with the integrated planning and management of the ground- and surface-water resources of the nation. The keystone of program development, implementation, and evaluation is and will continue to be water quality standards. To the extent that the goal 'Safe Drinking Water for Americans' has already been established, the point-of-use regulations should serve as water quality objectives, thus facilitating groundwater program formulation and evaluation. The major regulatory thrust of the program, the water quality standards, must be technology-based site selection, construction and operational standards, with only limited monitoring in a conventional water supply and water pollution control context. (Sims-ISWS)
W79-05124

GROUND-WATER QUALITY STANDARDS--IRRELEVANT,
F. A. Rayner.
Ground Water, Vol. 17, No. 1, p 39-44, January-February 1979.

Descriptors: *Groundwater, *Water quality standards, *Water pollution, *Legal aspects, Water pollution sources, Pollutants, Water quality, Path of pollutants, Water resources, Waste disposal, Irrigation, Sewage effluents, Aquifers, Regulation, Laws.

Proposals to establish national groundwater quality standards appear to be premature and redundant because of the geohydrologic and geochemical factors governing the occurrence and development of groundwater. Although it can be reasoned that there is no 'good time' to establish additional governmental standards (and the resultant additional governmental regulations), it can also be strongly argued that now is a 'bad time' to consider establishment of the proposed standards. First, a present mood of the general public is away from more governmental involvement in the business and private sectors, and a rebellion against the increasing cost of government. Second, the applicability and workability of present Federal (and some State) laws that could be used to adequately protect groundwater quality, have yet to be implemented or otherwise sufficiently tested. Equitable and workable groundwater quality protection could be fostered through the enactment of the long overdue requirements for the integration of surface- and groundwater development and management programs, without widening the existing gap between present groundwater and surface-water management structures. This integration would decrease inefficiency of use of these water resources--which are actually inseparable in identity to their users, the American taxpayers. (Sims-ISWS)
W79-05125

LAND APPLICATION OF WASTE--AN ACCIDENT WAITING TO HAPPEN,
Pirnie (Malcolm) Inc., Silver Spring, MD.
C. C. Johnson, Jr.
Ground Water, Vol. 17, No. 1, p 69-72, 1979. January-February, 1979. 14 ref.

Descriptors: *Waste water disposal, *Waste water treatment, *Sewage effluents, *Groundwater, Irrigation, Waste disposal, Water pollution sources, Water pollution, Pollutants, Path of pollutants, Soils, Groundwater movement, Water supply, Water wells, Aquifers, *Land application, Land treatment.

Half the population depends on groundwater for domestic uses. Use is increasing 25% per decade. Groundwater is generally used with little or no treatment. Some persons would transfer the discharge of our waste products from contaminated surface streams to the land and thus relatively clean groundwaters. No standards exist that protect groundwater quality. Research necessary to give assurance that natural interaction of waste water and soils will remove, to acceptable levels, potentially harmful contaminants, organic and inorganic, that permeate today's waste streams and today's health concerns, has not been done. Success reports on land treatment of waste water have not evaluated deterioration of groundwater from organic contamination. Most waste waters contain synthetic organics in varying concentrations. EPA recommends their reduction in drinking water to the lowest possible level. Most instances of groundwater contamination have been discovered after drinking water is contaminated. Unless the public is willing to treat groundwater as it does water from surface streams, greater control of land disposal practices must be exercised. Current practice does not indicate that necessary controls are contemplated or recognized. It follows that the widespread use of the land treatment alternative is, in reality, an accident waiting to happen. (Sims-ISWS)
W79-05126

THE FEDERAL GROUND-WATER PROTECTION PROGRAM--A REVIEW,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5G.
W79-05127

THE FEDERAL GROUND-WATER PROTECTION PROGRAM--TODAY'S HOPE,
Environmental Protection Agency, Dallas, TX.
For primary bibliographic entry see Field 5G.
W79-05128

MIXING MODEL FOR LARGE STREAMS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
L. Somlyody.
Progress in Water Technology, Vol. 10, No. 5/6, p 97-104, 1978. 8 fig, 21 ref.

Descriptors: *Mixing, *Rivers, *Streams, *Path of pollutants, *Model studies, Mathematical models, Numerical analysis, Water quality, Pollutants, Tracers, Diffusion, Water pollution, Simulation analysis, *Danube River.

In wide streams the variations in the water quality parameters are affected fundamentally by transverse mixing, which prohibits, in general, the use of one-dimensional water quality models. A two-dimensional mixing model applying to steady conditions was presented. The mixing model served as the basis for developing two-dimensional water quality models. The mixing model was formulated in a curvilinear coordinate system following the curvature conditions of the stream and contained depth integrated (average) values. The numerical solution based on the equations of the mass flux constant line, along which normal transport is zero, presents a visual geometric picture of the process. The difference scheme obtained is second order transversally, first order longitudinally, and explicit. Stability criteria of the solution were given, and the numerical solution was verified by checks against the possible analytical solutions. Practical applications of the model were illustrated by three numerical examples for the Danube. In the first the results of tracer observations were compared with those obtained analytically. The second applied to a 12 km long reach of the river. Actually observed NH4(+) values were compared to those obtained with the model. The pollution effect of a tributary stream was examined finally over a reach of 59.4 km length. A fair agreement between the values observed and computed demonstrated the validity of the model developed. (Sims-ISWS)
W79-05133

A MULTIVARIATE MODEL OF STORM-PERIOD SOLUTE BEHAVIOUR,
Exeter Univ. (England). Dept. of Geography.
I. D. L. Foster.
Journal of Hydrology, Vol. 39, No. 3/4, p 339-353, December 1978. 1 fig, 6 tab, 38 ref.

Descriptors: *Storm runoff, *Solutes, *Pollutants, *Model studies, Mathematical models, Runoff, Water pollution, Path of pollutants, Nutrients, Electrical conductance, Phosphorus, Calcium, Sodium, Magnesium, Chlorine, Flow, Rainfall, Precipitation(Atmospheric), Storms, Analytical

techniques, Water chemistry, Watersheds(Basins), Agricultural watersheds.

Three measures summarizing storm-period solute behavior and eight independent variables were employed in the development of stepwise multiple regression models in an attempt to identify the important hydrological and meteorological variables controlling solute response. The most appropriate predictive model of storm-period solute behavior was identified on the basis of the coefficient of determination, and the limitations of the models were discussed in relation to the stability of the multiple regression coefficients during each stage in independent variable selection. (Sims-ISWS)
W79-05144

BISCAYNE AQUIFER, SOUTHEAST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. Klein, and J. E. Hull.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 250, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-107, September 1978. 52 p, 25 fig, 4 tab, 28 ref.

Descriptors: *Aquifer characteristics, *Path of pollutants, *Groundwater movement, *Pumping, *Water supply, Municipal water, Water quality, Urban runoff, Septic tanks, Landfills, Leachate, Canals, Infiltration, Waste dilution, Groundwater recharge, Dispersion, Florida, *Biscayne aquifer, *Dade County, *Broward County, Safe Drinking Water Act.

Peak daily pumpage from the highly permeable, unconfined Biscayne aquifer for public water-supply systems in southeast Florida in 1975 was about 500 million gallons. Another 165 million gallons was withdrawn daily for irrigation. Recharge to the aquifer is primarily by local rainfall. Discharge is by evapotranspiration, canal drainage, coastal seepage, and pumping. Pollutants can enter the aquifer by direct infiltration from land surface or controlled canals, septic-tank and other drainfields, drainage wells, and solid-waste dumps. Most of the pollutants are concentrated in the upper 20 to 30 feet of the aquifer; public supply wells generally range in depth from about 75 to 150 feet. Dilution, dispersion, and adsorption tend to reduce the concentrations. Seasonal heavy rainfall and canal discharge accelerate ground-water circulation, thereby tending to dilute and flush upper zones of the aquifer. The ultimate fate of pollutants in the aquifer is the ocean, although some may be adsorbed by the aquifer materials en route to the ocean, and some are diverted to pumping wells. (Woodard-USGS)
W79-05155

ANALYSIS OF URBAN STORM-WATER-QUALITY FROM SEVEN BASINS NEAR PORTLAND, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
T. L. Miller, and S. W. McKenzie.
Geological Survey open-file report 78-662, 1978. 47 p, 13 fig, 16 tab, 18 ref.

Descriptors: *Water quality, *Urban runoff, *Storm runoff, *Water analysis, *Chemical analysis, Sediment transport, Suspended load, Dissolved solids, Coliforms, Nitrogen compounds, Turbidity, Biochemical oxygen demand, Correlation analysis, Analytical analysis, Sampling, Regression analysis, Oregon, *Portland area.

Over a 1.5-year period, water-quality data were collected for seven small drainage basins in urban aeas of Portland, Oreg. Analysis of the data followed three approaches. First, the constituent concentrations were analyzed. Average concentrations of suspended sediment, settleable solids, and fecal coliform bacteria generally exceeded levels expected for secondary waste-treatment plant effluent, whereas biochemical oxygen demand concentrations were lower than expected. The second analytical approach established correlations and bivariate regression relationships between constituents for individual storms in each basin, for all storms in each basin, and for all storms in all basins. Generally, correlation coefficients decreased when progressing from data for individual storms in each basin, to data for all storms in each basin, to data for all storms in all basins. In the third approach, storm yields for 10 constituents were related to basin and precipitation characteristics by use of multiple-linear-regression techniques. Storm yields for suspended sediment varied by about four orders of magnitude. Generally, results of the multiple-regression analysis indicated that variations in storm yields were highly dependent on precipitation characteristics, with total rainfall of the storm frequently explaining most of the variation of the dependent variable. (Woodard-USGS)
W79-05156

MAGNITUDES, NATURE, AND EFFECTS OF POINT AND NONPOINT DISCHARGES IN THE CHATTAHOOCHEE RIVER BASIN, ATLANTA TO WEST POINT DAM, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
J. K. Stamer, R. N. Cherry, R. E. Faye, and R. L. Kleckner.
Geological Survey open-file report 78-577, 1978. 74 p, 27 fig, 22 tab, 29 ref.

Descriptors: *Water pollution sources, *Inflow, *Streams, *Water analysis, *Water pollution control, Streamflow, Flow rates, Data collections, Chemical analysis, Dissolved solids, Biochemical oxygen demand, Nitrification, Algae, Regulated flow, Urbanization, Powerplants, Thermal pollution, Waste water treatment, Georgia, *Chattahoochee River, *West Point Lake, *Point-source discharge, Nonpoint-source discharge.

On an average annual basis and during the storm period of March 12-15, 1976, nonpoint-source loads for most constituents were larger than point-source loads at the Whitesburg station, located on the Chattahoochee River about 40 miles downstream from Atlanta, GA. Most of the nonpoint-source constituent loads in the Atlanta to Whitesburg reach were from urban areas. Average annual point-source discharges accounted for about 50 percent of the dissolved nitrogen, total nitrogen, and total phosphorus loads and about 70 percent of the dissolved phosphorus loads at Whitesburg. During a low-flow period, June 1-2, 1977, five municipal point-sources contributed 63 percent of the ultimate biochemical oxygen demand, and 97 percent of the ammonium nitrogen loads at the Franklin station, at the upstream end of West Point Lake. Dissolved-oxygen concentrations of 4.1 to 5.0 milligrams per liter occurred in a 22-mile reach of the river downstream from Atlanta due about equally to nitrogenous and carbonaceous oxygen demands. The heat load from two thermoelectric powerplants caused a decrease in dissolved-oxygen concentration of about 0.2 milligrams per liter. Phytoplankton concentrations in West Point Lake, about 70 miles downstream from Atlanta, could exceed three million cells per millimeter during extended low-flow periods in the summer with present point-source phosphorus loads. (Woodard-USGS)
W79-05157

STORM-WATER DATA FOR BEAR CREEK BASIN, JACKSON COUNTY, OREGON, 1977-78,
Geological Survey, Portland, OR. Water Resources Div.
L. A. Wittenberg.
Geological Survey open-file report 79-217, 1978. 28 p, 1 fig, 5 tab, 7 ref.

Descriptors: *Water quality, *Storm water, *Land use, *Urban runoff, *Water pollution, Water analysis, Dissolved solids, Nutrients, Bacteria, Lead, Sampling, Streamflow, Flow rates, Rainfall, Rain gages, Oregon, *Bear Creek basin, Jackson County.

Storm-water-quality samples were collected from four subbasins in the Bear Creek basin in southern Oregon. These subbasins vary in drainage size, channel slope, effective impervious area, and land use. Automatic water-quality samplers and precipitation and discharge gages were set up in each of the four subbasins. During the period October 1977 through May 1978, 19 sets of samples, including two base-flow samples, were collected. Fecal coliform bacteria colonies per 100-milliliter sample ranged from less than 1,000 to more than 1,000,000. Suspended-sediment concentrations ranged from less than 1 to more than 2,300 milligrams per liter. One subbasin consisting of downtown businesses and streets with heavy vehicular traffic was monitored for lead. Total lead values ranging from 100 to 1,900 micrograms per liter were measured during one storm event. (Woodard-USGS)
W79-05171

FINGERLING AMERICAN SHAD: EFFECT OF VALIUM, MS-222, AND SODIUM CHLORIDE ON HANDLING MORTALITY,
Georgia Univ., Savannah. Coastal Plain Station.
T. Murai, J. W. Andrews, and J. W. Muller.
The Progressive Fish Culturist, Vol. 41, No. 1, p 27-29, 1979, 1 tab, 15 ref.

Descriptors: *Salinity, Fish migration, Anadromous fish, Methodology, Fish physiology, Fish behavior, Mortality, Handling mortality, Fish handling facilities, Fish migration, *Sodium chloride, *Valium, *MS-222, Shad.

Two experiments were conducted to study the effects of Valium, MS-222, and sodium chloride on the mortality induced by handling and transporting fingerling American shad. Fish that were given an oral administration of Valium (0.04 mg/kg fish) and transferred without removal from the water (water transfer), showed nearly 100% survival for 24 h in a polyethylene bag without any delayed mortality. Oral administration of Valium (0.08 mg/kg fish) did not prevent high mortality (more than 80%) when scale losses were excessive. Addition of sodium chloride to the transporting water (1%) showed a significant beneficial effect on survival for up to 4 h; however, it was not effective in preventing mortality caused by severe scale losses. MS-222 at a concentration of only 10 mg/L proved to be toxic to shad. (Katz-EIS)
W79-05179

RAPID VACUUM METHOD FOR REMOVAL OF MUCUS FROM THE EPIDERMIS OF FISHES,
Louisville Univ., KY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-05180

PALAEMONID SHRIMP, MACROBRACHIUM AMAZONICUM: EFFECTS OF SALINITY AND TEMPERATURE ON SURVIVAL,
Texas Parks and Wildlife Dept., Ingram. Heart of Hills Fisheries Research Station.
W. C. Guest, and P. P. Durocher.
The Progressive Fish Culturist, Vol. 41, No. 1, p 14-18, 1979. 2 tab, 3 fig, 13 ref.

Descriptors: *Shrimp, *Water temperature, *Salinity, Bioassay, Mortality, Sea water, Animal physiology, Crustaceans, Juvenile growth stages, Survival, Paleominid shrimp, Macrobrochium, Aquiculture, Acute cold shock, Larvae, Larval growth stage, Optimal salinity.

Survival of larval Macrobrachium was evaluated at salinities of 0.0, 2.5, 5.0, 7.5, 10.0, 12.5, and 15.0%. The effects of acute cold shock and a gradual temperature decline (2.0C/day) on larvae, postlarvae, and juveniles were also evaluated. Larvae metamorphosed to postlarvae at all salinities except 0.0%; survival was 64% at 10.0% and 25% at 2.5%. Larvae were most resistant to cold shock at 10.0% salinity. In gradually declining temperatures, all life stages began losing equilibrium at 14.0C. Shrimp held in salinities within their optimal range (10.0 - 12.0%) were the most resistant to low temperatures. (Katz-EIS)
W79-05181

COMPARATIVE STUDIES ON METHODS FOR DETERMINING TOTAL MERCURY IN FISH. DITHIZONE AND FLAMELESS ATOMIC ABSORPTION SPECTROPHOTOMETRY TECHNIQUES,
Instytut Technologii zym Zywnosci Pochodzinia Morskiego, Szczecin (Poland).
M. Protasowicki, A. Ociepa, and A. Chodyniecki.
Zeszyty Naukowe Akademii Rolniczej w Szczecinie, Vol. 63 p. 55-62 1977, 2 tab, 25 ref. Polish, English Summary.

Descriptors: *Chemical analysis, *Spectrophotometry, *Mercury herrings, Laboratory tests, Analytical techniques, Path of pollutants, Heavy metals, Pollutant identification, Fish physiology, Methodology, Methyl mercury, *Tissue analysis, *Dithizone method.

Two methods for determining total mercury in fish were compared: the dithizone and flameless atomic absorption spectrophotometry techniques. The studies involved determination of recovery when 1 ug of mercury as solutions of Hg C12 or CH3HgC were added to each sample of herring flesh. Mean recoveries in the dithizone method were found to be 91.4 + 7.47% and 90.25 + 4.73% for the two solutions respectively, while the recoveries obtained with the flameless atomic absorption spectrophotometry were 95.00 + 9.13% and 98.70 + 7.14%, respectively. The results obtained with the dithizone method are comparable with those obtained with the flameless atomic absorption spectrophotometry for mercury contents of the magnitude order of 0.050 ug.g-1. (Deal-EIS).
W79-05183

CHANGES IN THE SPECIES COMPOSITION OF FISH IN THE RIVER LOT,
Toulouse-3 Univ. (France). Lab. d'Hydrobiologie.
J. N. Toureno, and F. Dauba.
Annales de Limnologie, Vol. 14, No. 1-2, p 133-138, 1978. 5 tab, 2 ref.

Descriptors: *Reservoir construction, *Reservoirs, *Fish populations, Spatial distribution, Freshwater fish, Brown trout, Bass, Perches, Carp, Sunfishes, Construction, River flow, Water temperature, *River Lot, France.

The disturbances in the river Lot caused by the construction of large reservoirs in the upper Lot and its tributary the Truyere have modified the distribution of the principal fish species, particularly in the barbel zone. However, the overall distribution of fish species in the river remains normal and downstream the distribution is characteristic of a lowland river with abundant fish. (Deal-EIS)
W79-05184

EARLY SAMPLES OF OIL IN WATER AND SOME ANALYSES OF ZOOPLANKTON,
Torry Research Station, Aberdeen (Scotland).
For primary bibliographic entry see Field 5A.
W79-05186

THE ECOLOGICAL IMPACT ON AND NEAR SHORES BY THE AMOCO CADIZ OIL SPILL,
Universite de Bretagne-Occidentale, Brest (France). Inst. d'Etudes Marine.
C. Chasse.
Marine Pollution Bulletin, Vol. 9, No. 11, p 298-301, 1978. 2 tab, 1 fig, 3 ref.

Descriptors: *Oil, *Oil pollution, *Water pollution effects, *Amoco Cadiz, *On-site-investigation, Environmental effects, Ecology, Rocks, Rocky shores, Benthos, Littoral fauna, Seaweeds, Littoral algae, Crustacea, Shrimp, Bay of Morlaix, Molluscs, Gastropods, Ecological effects, Commercial fish.

By comparison with previous pollution accidents and taking into account the enormous quantity of oil spilled at Portsall, the provisional balance sheet indicates rather less damage to the marine environment than might have been expected. (1) There is now evidence that intertidally and close inshore direct mortalities have been localized, seldom heavy and always selective and partial. (2) Contamination of organisms and products of commercial fisheries at sea have been transitory. Oyster culture alone has been badly damaged. (3) The algal crop is now exploitable for industrial use. (4) The general cover of macro-algae has survived the incident. (Katz-EIS)
W79-05190

SURVIVAL OF SALMON SMOLTS IN SEA WATER AFTER EXPOSURE TO AIR-SUPERSATURATED WATER,
Corvallis Environmental Protection Agency, OR. Western Fish Toxicology Station.
A. V. Nebeker, D. G. Stevens, and R. J. Baker.
The Progressive Fish Culturist, Vol. 41, No. 1, p 30-32, 1979. 2 tab, 1 fig, 11 ref.

Descriptors: *Bioassays, Laboratory tests, Salmon, *Sockeye Salmon, *Gas bubble disease, Fish diseases, *Supersaturation, Atmospheric gases, Fish physiology, Sea water, Freshwater fish, Bioassay, Methodology, Laboratory equipment.

Smolts of sockeye salmon (Oncorhynchus nerka) were held at 117, 115, 113, 110, 108, and 100% saturation in air-supersatured fresh water at 12.5C for 3 weeks. At 117% saturation 70% of the fish died, and at 115%, 5% died. Survivors were severely stressed and exhibited many signs of gas bubble disease. When the smolts were transferred to sea water and held for 10 days, no deaths occurred and they recovered rapidly. (Katz-EIS)
W79-05191

BIRDS OILED DURING THE AMOCO CADIZ INCIDENT - AN INTERIM REPORT,
Royal Society for the Protection of Birds Sandy (England).
P. H. Jones, J. Y. Monnat, C. J. Cadbury, and T. J. Stowe.
Marine Pollution Bulletin, Vol. 9, No. 11, p 307-310, 1978. 2 tab, 1 fig, 8 ref.

Descriptors: *Oil, *Oil spills, *Water pollution effects, *Amoco Cadiz, *Birds, Bird types, Oiled birds, Mortality, Water birds, Atlantic Ocean, Puffins, Razorbills, Guillemots, Auks, Brittany, On-site-investigations, Corpse drift experiment.

Over 4500 oiled birds were collected from beaches in Northwest France and the Channel Islands following the oil spillage from the Amoco Cadiz in March 1978. Auks were the most abundant casualties: 1391 puffins Fratercula arctica, 978 razorbills Alca torda and 731 guillemots Uria aalge, but there were also 126 divers Gavia spp. A total of 33 bird species were recorded oiled. A corpse drift experiment suggested that after 30 March at least 3450 seabirds died off north Finistere alone; the total mortality in the first fortnight of the incident was probably considerably larger. (Katz-EIS)
W79-05192

NOTES ON THE CONDITION IN SEPTEMBER 1978 OF SOME INTERTIDAL SANDS POLLUTED BY AMOCO CADIZ OIL,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
N. A. Holme.
Marine Pollution Bulletin, Vol. 9, No. 11, p 302, 1978.

Descriptors: *Oil, *Oil spills, *Amoco Cadiz, *Water pollution effects, Beaches, Sediments, Sand spits, *Sands, Sand discoloration, Littoral, Submerged oil, Surface sand, Benthos, Polychaetes, Molluscs, Toxicity, Meiofauna.

At the end of the summer a conspicuous feature of some beaches which had been heavily polluted by Amoco Cadiz oil spill six months previously was the strong development of grey or black layers close to the surface in sands which would not normally be discoloured at this depth. Recolonization of these beaches by meiofauna may be hindered by the reducing conditions. (Katz-EIS)
W79-05193

PRELIMINARY OBSERVATIONS ON POLLUTION OF THE SEA BED AND DISTURBANCE OF SUB-LITTORAL COMMUNITIES IN NORTHERN BRITTANY BY OIL FROM THE AMOCO CADIZ,
Station Biologique de Roscoff (France).
L. Cabioch, J. C. Dauvin, and F. Gentil.
Marine Pollution Bulletin, Vol. 9, No. 11, p 303-307, 1978. 1 tab, 3 fig, 6 ref.

Descriptors: *Oil, *Oil spills, *Water pollution effects, *Amoco Cadiz, Brittany Coast, France, Benthos, Littoral, Sub-littoral, Sea-bed, Sediments, Currents(Water), Sea bed morphology, Benthos, *Animal populations, Animal grouping, Estuaries, Bays, Bay of Morlaix, Benthic flora, Benthic fauna, Sediment pollution.

The final development of the disruption produced by hydrocarbons in sublittoral benthic communities is going to depend largely on two general conditions: on the one hand, on the natural capacity of the various types of habitat present to speed up or hinder their own cleansing; on the other, on the proximity of more or less large reserves for recolonisation. The peculiar benthic structure of northern Brittany, characterised by the presence of coarse, pebbly substrates continually exposed to strong tidal currents, has resulted in the harmful consequences of pollution being felt primarily by and even being concentrated in communities in fine sediment, isolated from each other in bays and estuaries. (Katz-EIS)
W79-05194

TOXICITY OF RESIDUAL CHLORINE COMPOUNDS TO AQUATIC ORGANISMS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
G. L. Larson, C. E. Warren, F. E. Hutchins, L. P. Lamperti, and D. A. Schlesinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 236, Price codes: A06 in paper copy. Environmental Protection Agency, Ecological Research Series, EPA 600/3-78-023, March 1978, p 105, 32 tab, 26 fig, 47 ref.

Descriptors: *Chlorine, *Chlorination, *Toxicity, *Bioassay, *Water pollution effects, Mortality, Freshwater fishes, Sewage, Sewage treatment, Disinfection, Aquatic animals, Methodology, Trout, Salmon, Minnows, Bullhead, Bass, Sunfish, Crayfish, Juvenile fish, *Chloramines.

Laboratory studies on the acute and chronic toxicity of chlorine and inorganic chloramines to trout, salmon, minnows, bullhead, largemouth bass, and bluegill were conducted. Acute toxicity under continous and intermittent patterns of exposure as well as behavioral, reproduction, development, and growth responses to low level exposures to residual chlorine compounds were determined. Acute and chronic toxicities of chloramines to crayfish were investigated. Algae, invertebrates, including insects, and juvenile salmon were exposed continously to relatively low levels of residual chloramine compounds inlaboratory stream communities. The acute toxicities of inorganic chloramines, as measured by 96-hour LC50 values, were less than 100 ug/1 for salmonids and were a function of life history stage, body size, and some water quality conditions. Whereas adult trout may live indefinitely at concentrations near 50 ug/1, the LC50 values for late developmental stages--fry and very small juveniles--were not much above this concentration. Effects on growth of alevins and juveniles had threshold concentration values between about 10 and 22 ug/1, effects being quite marked at 22 ug/1. In intermittent exposure to relatively high concentrations of free residual chlorine, mortality was found to be a rather consistent function of the area under the time-concentration curves of exposure, for different forms, durations, and frequencies of such patterns of exposure. Behavioral responses of fish, such as avoidance of chlorinated water which could be advantageous in nature and lethargic swimming, surfacing, and sinking to the bottom which would probably be harmful were studied. Such behaviors occur not only at acutely toxic concentrations but also at lower ones. (Katz-EIS)

W79-05197

ENVIRONMENTAL PATHWAYS OF SELECTED CHEMICALS IN FRESHWATER SYSTEMS PART II: LABORATORY STUDIES,
SRI International Menlo Park, CA.
For primary bibliographic entry see Field 5A.
W79-05198

INSECTICIDES: HCH, DDT, DDE, AND DDD IN SELECTED PACIFIC COMMERCIAL FISH SPECIES (IN POLISH),
Instytyt Technologii zym Zywnosei Pochodzenia Morskiego, Szczecin (Poland).
W. Ciereszko, and A. Chodyniecki.
Zeszyty Naukowe Akademii Rolniczej W Szczencinie, Vol. 63, p 47-54, 1977, 2 fig, 1 tab, 19 ref. (English summary).

Descriptors: *Insecticides, *Pesticide residues, *DDT, DDE, DDD, *Chlorinated hydrocarbon pesticides, Pesticide kinetics, Path of pollutants, Chemical analysis, Gas chromatography, Commercial fishing, Herrings, *Tissue analysis, *HCH, *Sebastes, *Theragra, *Merluccius, *Sola, Rockfish, Flatfish.

The mass application of chloroorganic insecticides, mainly HCH and DDT, has led to a considerable contamination of food products obtained from land and sea. Siz Pacific fish species were examined, the insecticides being assessed by gas chromatography. Mean contents of DDT, DDE, and DDD in fish examined varied, the highest content of summaric DDT being found in fat species like herring and Sebastes spp., 0.025-0.107 and 0.012-0.114 mg DDT kg-1, respectively. Lean fish yielded much lower contents (0.001-0.019 mg DDT kg-1). The HCH contents remained basically at the same level in all the species tested, the range being 0.0011-0.0042 mg HCH kg-1. The highest mean contents were attributed to DDE. In general, the Pacific fish were found to contain relatively small amounts of insecticides (HCH and DDT) as opposed to Baltic and North Atlantic fish. (Katz-EIS)
W79-05199

PREDICTING NIGHTTIME DISSOLVED OXYGEN DECLINE IN PONDS USED FOR TILAPIA CULTURE,
Alabama Univ., Auburn. Dept. of Fisheries and Allied Aquacultures.
R. P. Romaire, C. E. Boyd, and W. J. Collis.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 804-808, 1978. 1 fig, 3 tab, 9 ref.

Descriptors: *Simulation analysis, *Model studies, *Dissolved oxygen, *Tilapia, Mathematical models, Computer models, Biological communities, Freshwater fish, Respiration, Diurnal, Phytoplankton, Oxygen, Farm wastes, *Farm ponds, Nutrients.

A computer simulation model for predicting nighttime dissolved oxygen (DO) loss was developed for manured and unmanured tilapia ponds. The model incorporated data from the literature on O2 diffusion, respiration by the planktonic community, fish, and benthic organisms, and O2 consumption by organic manure. The average absolute deviation between calculated and measured DO concentrations was 0.49 mg/liter for unmanured ponds and 0.38 mg/liter for manured ponds. The contribution of plankton respiration to the total DO loss averaged 75% and 80% in unmanured and manured ponds, respectively. The utility of the model for predicting DO loss over a wide range of plankton densities, fish standing crops, and percentage O2 saturation values at dusk was demonstrated. The nighttime DO model should have universal applicability to other fish cultures provided a reliable method for estimating oxygen consumption by the cultured organism(s) is available. (Deal-EIS)
W79-05200

ANNOUNCEMENT OF COMPOUNDS REGISTERED FOR FISHERY USES,
National Fishery Research Lab., LaCrosse, WI.
For primary bibliographic entry see Field 5A.
W79-05205

THE RIOU-MORT A TRIBUTARY TO THE RIVER LOT POLLUTED BY HEAVY METALS. I. PRELIMINARY OBSERVATIONS ON THE CHEMISTRY AND BENTHIC ALGAE,
Toulouse-3 Univ. (France). Lab. d'Hydrobiologie.
P. J. Say.
Annales de Limnologie, Vol. 14, No. 1-2, p 113-131. 1978, 3 fig, 5 tab, 14 ref.

Descriptors: *Water chemistry, *Aquatic algae, *Zinc, Water pollution effects, Chemical wastes, Industrial wastes, Toxicity, Aquatic populations, Chemical analysis, Water analysis, Suspended solids, *Cadmium, *Copper, Sulfuric acid, *Manganese, Cladophora, Rivers, *Smelters, Riou-Mort, River Lot.

The Riou-Mort drains the heavily industrialized coal-bearing basin of Decazeville and is therefore the principal receiver of a diverse range of waste waters. Studies were made of the chemistry and benthic algae at 14 sites on the Riou-Mort and its tributaries and 7 sites on the river Lot. The former river and its tributaries are all severely polluted below the main centres of industry after receiving effluents discharged from a number of factories including a zinc smelter. The principal pollutants are suspended solids, zinc, cadmium, copper, sulphuric acid and manganese. Marked changes in the benthic algal flora occur below the sources of pollution on all the rivers. Under conditions of 'moderate' heavy metal pollution communities dominated by Cladophora glomerata, Ulothrix zonata, Vaucheria sp., Melosira varians and Synedra ulna are replaced by those domiated by Stigeoclonium tenue, Gongrosira incrustans, Gomphonema parvulum and Surirella ovata. Under extreme heavy metal pollution at certain sites no algal species were found whilst at others the flora is reduced to two species gomphonema parvulum and Achnanthes minutissima. A combination of high levels of suspended solids and high concentrations of zinc and cadmium produce the most severe effects on the benthic algae. (Deal-EIS)
W79-05206

CONCENTRATIONS OF SELECTED ELEMENTS AND ASH IN BLUEGILL (LEPOMIS MACROCHIRUS) AND CERTAIN OTHER FRESHWATER FISH,
Breedlove Associates, Inc., Gainesville, FL.
For primary bibliographic entry see Field 5A.
W79-05208

THE USE OF COPPEROXYCHLORIDE DURING LARVAL GROWTH AS A PREVENTATIVE MEASURE AGAINST THE SPREAD OF CILIATA-EXOPARASITES,
Warmwater Fish Hatchery (Hungary).
L. Horwath, M. Lang, and G. Tamas.
Bamidgeh, Vol. 30, No. 3, p 80-84, 1978. 2 tab, 13 ref.

Descriptors: *Fish parasites, *Carp, *Protozoa, Zooplankton, Toxicity, *Copper compounds, Chlorides, Larval growth stages, Metals, Fish farming, Copper sulfate, Fish physiology, Mortality, Fish management, *Tissue analysis, *Copperoxychloride.

Some copper compounds seemed to be likely candidates for prevention of parasite evoked damage to farmed larvae and fry of cyprinid fish (carp, silver-carp, grass-carp, and tench). Instead of the well known and effective but at the same time poisonous copper sulfate, we used the less toxic copperoxychloride. Before treatment of ponds, concentrations effective against parasites were determined under laboratory conditions. The therapeutic dose proved to be 4 mg/1; only twenty fold concentrations (i.e. 80 mg/1) were toxic to the fish. In pond treatments parasites were eliminated by the copper compound at a concentrations of 4 mg/1. When changes in technology were also instituted, fish developed well and there was no renewal of infection. (Deal-EIS)
W79-05209

APPLICATION OF PHASED COOLING TO A ONCE-THROUGH COOLING SYSTEM,
Auburn Univ., AL. Dept. of Mechanical Engineering.
J. A. MacFarlane, G. Maples, and D. F. Dyer.
Journal of Engineering for Power, American Society of Mechanical Engineers, p 365-367, July 1976. 5 fig. OWRT-A-039-ALA(1).

Descriptors: *Powerplants, *Cooling water, Heated water, *Thermal pollution, Phased cooling.

The use of once-through cooling for high capacity generating units, is becoming increasing impractical. Since passage for the Federal Water Pollution Control Act of 1965, the maximum allowable increase in water temperature for rivers and streams is 5F. For a large power plant, this 5F rise requires a condenser flow rate which surpasses the average flow of most rivers in the United States. Through employment of the 'phase-cooling' concept however, an alternative form of once-through cooling can be developed which will meet the Federal Water Pollution Control Act standards. The model and equations used are similar to those described elsewhere. (See also W79-05228)
W79-05227

REJECTION OF WASTE HEAT FROM POWER PLANTS THROUGH PHASED-COOLING,
Auburn Univ., AL. Dept. of Mechanical Engineering.
J. A. MacFarlane, J. S. Goodling, and G. Maples.
Journal of Engineering for Power, American Society of Mechanical Engineers, p 117-124, January 1975. 7 fig, 21 ref. OWRT-A-031-ALA(4).

Descriptors: *Cooling water, Powerplants, *Thermal pollution, Heated water, Storage ponds, Cooling ponds, Phased cooling.

Because of the disadvantages associated with present power plant cooling systems, a new concept in waste heat dissipation, called 'phased-cooling,' is introduced. Heated condenser cooling water is held in a storage pond during certain hours of the day, to be cooled at a later time by traveling across a cooling surface. A thermodynamic analysis of the system is performed, and the equations of heat transfer from a water surface are presented. The developed model is then used for prediction of system performance. The optimum number of storage hours is shown to be dependent upon the size of the system, the season, and meteorological conditions. Phased-cooling evaporation losses are approximately 40 percent less than those of cooling towers and cooling ponds. Condenser inlet temperatures are significantly lower than those of cooling ponds of similar size.
W79-05228

IDENTIFICATION OF MAJOR ORGANIC CONSTITUENTS IN TEXTILE WASTE WATER RESULTING FROM THE USE OF SULFUR DYES,
Auburn Univ., AL. Dept. of Consumer Affairs.
B. L. Slaten.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 359, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute, Auburn University, Bulletin 35, March 1979. 14 p, 8 ref. OWRT A-053-ALA(1).

Descriptors: *Organic compounds, *Textile wastes, Sulfur dyes, Dyes, Chromatography, XAD-2 resin.

The waste water from textile dyeing facilities contains many organic contaminants. A laboratory simulation of the sulfur dyeing of cotton fabrics was done in order to determine the nature of the by-products normally discharged in textile waste water systems. The organic constituents resulting from these laboratory dyeings were removed from water solution using liquid-solids chromatography and XAD-2 resin. The organic fractions so ob-

tained in several eluting solvents were further separated by a second separation using silica gel chromatography. These fractions were then examined using various analytical techniques. It was determined that the waste water resulting from sulfur dyeings contained in excess of 200 different organic constituents varying in molecular weight and nature of functional groups.
W79-05230

MIXING OF POWER-PLANT HEATED EFFLUENTS WITH THE MISSOURI RIVER,
Iowa Univ. Iowa City. Inst. of Hydraulic Research.
R. Caro-Cordero, and W. W. Sayre.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 633, Price codes: A07 in paper copy, A01 in microfiche. IHR Report No. 203, June 1977. 141 p, 56 fig, 9 tab, 20 ref, 2 append.

Descriptors: *Model studies, *Thermal powerplants, *Missouri River, *Heated water, *Mixing, *River flow, Water cooling, Hydraulics, Turbulent flow, Channel morphology, On-site investigations, Temperature, Mixing, *Thermal plumes, Temperature distribution, Transverse mixing.

Thermal plume data obtained in the Missouri River downstream from the Fort Calhoun and Cooper Nuclear Stations, together with detailed information about the channel geometry needed to synthesize the transverse flow distribution, were used to adapt and refine a mathematical model for steady-state transverse mixing in natural streams for the purpose of predicting thermal plumes in fast-flowing turbulent rivers such as the Missouri River. In addition to the transverse distribution of flow, the model requires two parameters, one relating to the initial near-field dilution resulting from the interaction of the thermal discharge with the ambient flow, and the other governing the far-field transverse mixing due to mechanism associated with the ambient flow. Twelve sets of plume data were analyzed to determine the values of the parameters which provide the best agreement between observed and computed distributions of temperature rise with respect to cumulative discharge across the channel. The model was shown to provide a good basis for predicting thermal plumes in the Missouri River and similar streams. (Singh-ISWS)
W79-05245

ACOUSTIC MONITORING OF INDUSTRIAL CHEMICAL WASTE RELEASE AT DEEP WATER DUMP SITE 106,
Woods Hole Oceanographic Institution, MA. Dept. of Ocean Engineering.
M. H. Orr, and F. R. Hess.
Journal of Geophysical Research, Vol. 83, No. C12, p 6145-6154, December 20, 1978. 10 fig, 16 ref. NOAA 04-6-158-40072, 7-35181.

Descriptors: *Waste disposal, *Chemical wastes, *Remote sensing, *Acoustics, Waste dumps, Continental slope, Dispersion, Flocculation, Chemical precipitation, Dye releases, Dye dispersion, Oceans, Pollutants, Path of pollutants, Mixing, Water pollution, Monitoring, Industrial chemical wastes.

Some industrial chemical wastes form flocs or particles upon being introduced into seawater. High-frequency acoustic backscattering systems were used to study the dispersion of the particulate phase of industrial chemical waste in a water column (depths of more than 1500 m) with a sharp seasonal thermocline. The particles were found to remain trapped for extended periods (at least 74 hours) in the mixed layer, to accumulate on the density structure found between the mixed layer and the seasonal thermocline, to accumulate on the density structure associated with the seasonal thermocline, and on occasion, to penetrate the seasonal thermocline and form a diffuse cloud in the main thermocline. The effluent phase of the chemical waste, which was tagged with rhodamine WT dye, was found to remain in the vicinity of the particulate phase of the waste. (Sims-ISWS)
W79-05264

OUTPUT OF WATER, SUSPENDED SEDIMENT, AND PHOSPHORUS FORMS FROM A SMALL AGRICULTURAL CATCHMENT,
Marlborough Catchment and Regional Water Board, Blenheim, (New Zealand).
B. J. Bargh.
New Zealand Journal of Agricultural Research, Vol. 21, No. 1, February 1978, p 29-38. 4 fig, 4 tab, 25 ref.

Descriptors: *Agricultural runoff, *Phosphorus, *Nitrogen, *Suspended solids, *Streamflow, *Tuapaka Catchment(New Zealand), *Path of pollutants, *Water pollution sources, Tararua Ranges(New Zealand), New Zealand, Watersheds(Basins), Percolation, Rainfall, Storm runoff, Fertilization, Phosphates, Nitrogen fixation, Clover, Particulates, Nutrients, Sedimentation, Manawatu River(New Zealand).

A one-year study (1974-75) outputs of water, suspended sediment, and phosphorus and nitrogen forms from the 180-ha Tuapaka Catchment, an agricultural area in the northern Tararua Ranges, New Zealand, showed that 26% of total rainfall was discharged as streamflow. Significant quantities of phosphorus and nitrogen were associated with suspended sediment output, which amounted to 1400 kg/ha. Of the annual loss of total phosphorus (1.6 kg/ha), 76% was particulate, and of the 5.2 kg/ha annual output of total nitrogen, 14% was particulate. Phosphate fertilizer application was the major source of phosphorus input, and clover nitrogen fixation and rainfall the major nitrogen sources. Average annual rainfall in New Zealand is 1000 mm, uniform throughout the year; during the study year rainfall was 1048 mm. The catchment rises 80-400 m a.s.l., and drains into the Manawatu River. A water balance estimate for the basin indicated minimal deep percolation. Baseflow events during the drier summer months were about one liter/sec, increasing to 10 liters/sec during winters. Peak storm discharges varied from 100-2870 liters/sec. A total of 273.1 mm of annual rainfall (26%) was discharged as streamflow. Total suspended sediment discharged was 252 t. The pattern of suspended sediment output apparently depended on antecedent moisture content, rainfall quality and intensity, and land management. Total dissolved load was 31.8 t (11% of the total load). (Lynch-Wisconsin)
W79-05344

SOME ASPECTS OF SEDIMENT DISTRIBUTION AND MACROPHYTE CYCLING OF HEAVY METALS,
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.
For primary bibliographic entry see Field 5C.
W79-05353

REMOTE SENSING FOR OIL POLLUTION CONTROL ALONG COASTAL WATERS OF THE UNITED STATES,
Coast Guard Research and Development Center, Groton, CT.
For primary bibliographic entry see Field 7B.
W79-05393

EVALUATION OF THE EFFECTS OF URBANIZATION ON STORMWATER RUNOFF AND QUALITY,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W79-05400

STORMWATER MANAGEMENT MODEL: TRANSFER OF TECHNOLOGY,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
H. C. Torno.
In: Water Knowledge Transfer. Volume 2, Proceedings of the Second International Conference on Transfer of Water Resources Knowledge, June 1977, Fort Collins, Colorado. N.S. Grigg, et al., Editors, Water Resources Publications, Fort Collins, Colorado, 1978, p 587-591.

Descriptors: *Storm water, *Management, *Technology transfer, Programs, *Mathematical models, Urban drainage, Simulation analysis, Systems analysis.

Since its development in 1970, the U.S. Environmental Protection Agency's Storm Water Management Model (SWMM) has become the most widely used urban drainage model in the United States and Canada, and it has received extensive application in other countries. While the principle reason for this is conceptual soundness and utility, an effective technology transfer program has been central to its continued popularity with engineers and planners in both the public and private sectors. There are numerous key ingredients in the success of this technology transfer program. Included are: (1) good model documentation, including test data, which is updated concurrently with model changes; (2) a simple, informal and responsive mechanism for making the model available to users; (3) workshops to train potential users; and (4) a continuing commitment to maintain the model. Except for the last of these, technology transfer is accomplished with a minimal expenditure of resources. The SWMM Users Group currently numbers some 275 firms and individuals, and meetings feature a wide variety of presentations, including information on the application of a wide variety of models. (See also W79-05409) (Bell-Cornell)
W79-05412

REFINER PULP MILL EFFLUENT. PART 2. COMPOSITION OF DISSOLVED SOLIDS FRACTION,
New Zealand Forest Service, Rotorua.
S. R. Corson, and J. A. Lloyd.
Paperi ja Puu, Vol. 60, No. 8, p 435-439, August, 1978. 2 fig, 3 ref, 7 tab.

Descriptors: *Pulp wastes, *Dissolved solids, *Groundwood mills, Suspended solids, Dissolved solids, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Carbohydrates, Color, White water(Paper machine), Fatty acids, Resin acids, Organic compounds.

Most of the dissolved solids in the white-water and effluent streams of refiner groundwood (chip groundwood) mills are derived from carbohydrates. These compounds amount to 2000-3000 mg/liter in the white-water overflow and are responsible for the characteristic brown color of the effluent. Small quantities (100-200 mg/liter) of ether-soluble extractives were also present in white water. Resin acids in the effluent amounted to 40 mg/liter. The ratio of resin acids to fatty acids in the dissolved effluent solids was as high as 80:20, compared to 40:60 in the suspended solids and 55:45 in the pulpwood entering the mill and in the pulp fiber leaving it. (Brown-IPC)
W79-05496

5C. Effects Of Pollution

EFFECT OF PHOSPHORUS SUPPLY ON ALGAL BIOMASS IN A TURBID MISSOURI RESERVOIR,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
J. T. Novak, P. J. Jones, C. Crisp, N. Crisp, and F. Cunningham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 183, Price codes: A06 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri Completion Report, March 1979. 104 p, 51 fig, 4 tab, 44 ref. OWRT A-095-MO(1). 14-34-0001-7053, 7054, 8027.

Descriptors: *Phosphorus, Chlorophyll, Turbidity, *Primary production, Lakes, Algal blooms, Biomass.

The objective was to determine the relationship between primary productivity and phosphorus levels in the Lake of the Ozarks. The Lake of the Ozarks is large man-made impoundment that is fed

primarily by the Osage River. Although this river contains a large quantity of phosphorus, productivity is low. This research was designed to clarify the relationship between suspended solids levels and phosphorus availability. Data obtained suggest that inorganic phosphorus entering the Lake of the Ozarks may not have as great an impact on productivity as point source inputs. Productivity is limited because of the high flushing rates in the lake and because of limited availability of bound phosphorus. The data further indicate that light availability may not be as important in turbid manmade reservoirs as the impact of silt on phosphorus availability. When this study began it was a goal to evaluate the impact of impounding the Osage River upstream of the Lake of the Ozarks. Although not conclusive, it appears that the impoundment may improve water quality by decreasing the turbidity level in the Osage arm of the Lake of the Ozarks and reducing phosphorus inputs.
W79-05001

BIOLOGICAL ASSESSMENT OF TIMBER MANAGEMENT ACTIVITY IMPACTS AND BUFFER STRIP EFFECTIVENESS ON NATIONAL FORESTS STREAMS OF NORTHERN CALIFORNIA,
California Univ., Berkeley. Dept. of Forestry and Conservation.
K. B. Roby, D. C. Erman, and D. J. Newbold.
Earth Resources, Monograph No. 1, Forest Service/USDA, Region 5, California, December 1977. 169 p, 3 fig, 12 tab, 11 append. (California Water Resources Center Project UCAL-WRC-W-411), OWRT A-047-CAL(4).

Descriptors: *Invertebrates, *Lumbering, *Biological communities, *Vegetation effects, *Environmental effects, Erosion control, Bank stability, Bank protection, Watershed management, Forest management, Slope protection, Cutting management, Running waters.

A method for assessment of logging impacts on water quality, using aquatic invertebrate communities, is presented. The analysis is based on comparison of invertebrates taken from one logged and two unlogged streams. 'Community diversity' (as Shannon Diversity Index) and 'ecological distance' (as Euclidean distance) are used in tandem to evaluate the impact of timber management practices. Analysis based on identification of organisms to the generic level gave best results, but those based on family level determinations also yielded statistically signficant results. The method was developed from a research project which sampled 62 streams in northern California. The results showed aquatic invertebrate communities were significant indicators of streams logged without adequate protective measures. Streams with narrow buffer strips were variable in provision of protection, but those streams with buffers greater than 30m in width showed no effects of logging. In addition to invertebrate analysis, chemical and physical parameters of water quality were sampled. Only one parameter, stream channel stability ratings, was effective in distinguishing between logged and unlogged streams. The data provide a comprehensive picture of existing conditions in northern California streams. (Snyder-Calif. Davis)
W79-05005

DIATOM COMMUNITY STRUCTURE: TAXONOMIC AND STATISTICAL ANALYSES OF A MISSISSIPPI SALT MARSH,
Mississippi State Univ., Mississippi State. Dept. of Botany.
M. J. Sullivan.
Journal of Phycology, Vol. 14, No. 4, 468-475, December 1978. 3 fig, 4 tab, 13 ref. OWRT A-099-MISS(4), 14-34-0001-7052.

Descriptors: *Diatoms, *Salt marshes, *Soil algae, Ecological distribution, Biogeography, Biological communities, Mississippi, Bulrush, Graveline Bay Marsh(Miss), Spartina, Juncus, Distichlis, Navicula.

Edaphic diatoms were collected on a seasonal basis from beneath five monospecific stands of spermatophytes on Graveline Bay Marsh (Mississippi) from 14 October 1976 through 21 June 1977. Of the 119 diatom taxa encountered, only seven were restricted to a single edaphic habitat, and five of these accounted for 17.2% of the individuals comprising the community associated with Distichlis spicata (L.) Greene. The most abundant diatom was Navicula tripunctata (Mull.) Bory, which accounted for 21.5% of all individuals counted during the study. Based on a 2-way ANOVA of species diversity (H') and the number of taxa in a sample, edaphic diatom community diversity was highest beneath D. spicata and Spartina patens (Ait.) Muhl., lowest beneath Sp. alterniflora Loisel. and Juncus roemerianus Scheele, and somewhat intermediate for the Scirpus olneyi Gray habitat. Structural differences between selected community pairs were quantified using a similarity index (SIMI) and the values generated were exceedingly variable. A multiple regression analysis revealed that structural differences among edaphic diatom communities were related to differences in elevation, far red light energy, ammonia nitrogen, soil moisture, and tentatively, height of the spermatophyte canopy.
W79-05007

COPPER, NICKEL, AND ZINC RELEASED FROM ACID COAL MINE SPOIL MATERIALS OF EASTERN KENTUCKY,
Kentucky Univ., Lexington. Div. of Regulatory Services.
For primary bibliographic entry see Field 5A.
W79-05044

PRELIMINARY RESULTS CONCERNING EFFECTS OF CHLORINE ON MONOSPECIFIC MARINE PHYTOPLANKTON,
Universite de Bretagne-Occidentale, Brest (France). Lab. de Physiologie Vegetale.
For primary bibliographic entry see Field 5B.
W79-05093

PREDICTING EFFECTS OF COLD SHOCK: MODELING THE DECLINE OF A THERMAL PLUME,
Battelle Pacific Northwest Labs., Richland, WA. Ecosystems Dept.
For primary bibliographic entry see Field 5B.
W79-05094

TOXICITY OF PHOSSY WATER TO SELECTED FRESHWATER ORGANISMS,
Army Armament Research and Development Command, Aberdeen Proving Ground, MD. Chemical Systems Lab.
For primary bibliographic entry see Field 5B.
W79-05095

TRACE METAL CONTAMINATION OF THE ROCK SCALLOP, HINNITES GIGANTEUS, NEAR A LARGE SOUTHERN CALIFORNIA MUNICIPAL OUTFALL,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W79-05096

POLLUTION-ASSOCIATED DISEASES AND ABNORMALITIES OF FISH AND SHELLFISH: A REVIEW,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
C. J. Sindermann.
Fishery Bulletin, Vol. 76, No. 4, p 717-749, 1979. 8 fig, 235 ref.

Descriptors: *Fish diseases, *Animal pathology, *Toxicity, Water pollution effects, Shellfish, Crustaceans, Viruses, Pathogenic bacteria, Infection, Chlorinated hydrocarbon pesticides, Genetics, Animal physiology, DDT, Polychlorinated biphenyls, 2,4-D, Chemical wastes, Industrial wastes, Pesticides toxicity, Fish physiology, Molluska, Fin erosion, *Tissue analysis, Neoplasms, Mutagens.

The relationship of disease and environmental stress is becoming increasingly well established with time. Human activities-particularly those that result in chemical additions to the coastal/estuarine environment have increased the potential stresses on fish and shellfish inhabiting those areas. Circumstantial evidence for associations of pollutants with certain fish and shellfish diseases and abnormalities is accumulating. This paper attempts to review and evaluate existing information about associations of diseases and marine environmental degradation. Emphasis has been placed on: diseases caused by contaminant stress and related facultative pathogens; stress-provoked latent infections; environmentally induced abnormalities, genetic abnormalities associated with mutagenic and other properties of contaminants; experimentally induced lesions; contaminant effects on resistance and immune responses; and pollutant-parasite interactions. There are several diseases, particularly fin erosion and ulcers in fish and shell diseases in crustaceans, for which a relationship with pollution seems evident, and there are a number of other diseases or abnormalities (such as certain neoplasms and skeletal anomalies) for which a relationship with pollution is indicated. Furthermore, there is some evidence that certain latent viral infections may be provoked into patency by environmental stress. (Deal-EIS)
W79-05097

THE INFLUENCE OF TURBIDITY ON NET PHYTOPLANKTON PHOTOSYNTHESIS IN SOME IRISH LAKES,
New Univ. of Ulster, Coleraine (Northern Ireland). Limnology Lab.
D. H. Jewson, and J. A. Taylor.
Freshwater Biology, Vol. 8, p 573-584, 1978. 12 fig, 2 tab, 39 ref.

Descriptors: *Photosynthesis, *Phytoplankton, *Euphotic zone, *Turbidity, Chlorophyll, Lakes, Light, Aquatic algae, Nutrients, Light penetration, Light quality, Light intensity, Spectrophotometry, Optical properties, Ulster, L. Neagh, Northern Ireland.

An important influence on gross photosynthetic rates per unit area is the success with which phytoplankton competes for the available light with non-algal suspended material and dissolved organic compounds. Using a range of Irish lakes, with euphotic zones varying between 0.7 and 20 m and with chlorophyll-a values between 1 and 860 mgm-3, the effect on gross rates of photosynthesis is analysed for changes in the balance between the factors contributing to light attenuation. Net values per unit are also likely to be modified in well-mixed systems as the ratio of light to dark regions in the water column are altered with changes in light penetration. Depth gradients in dark respiration are reported for L. Neagh which vary according to previous light history and nutrient stress. Possible cases of restraint on phytoplankton growth are discussed for optically deep situations. (Deal-EIS)
W79-05098

HISTOPATHOLOGICAL CHANGES IN THE FISH AFTER INTOXICATION WITH NON-IONOGENIC TENSIDES ON THE BASIS OF ETHOXYL ADUCTS OF ISONONYLPHENOLS (HISTOPATOLOGICKE ZMENY U RYB PO INTOXIKACI NEIONOGENNIMI TENZIDY NA BAZI ETHOXYLOVYCH ADUKTU ISONONYLFENOLU),
Vysoka Skola Veterinarni Brno (Czechoslavakia).
L. Groch, and Z. Svobodova.
Buletin Vurh Vodnany, Vol. 14, p 19-26, 1978. 6 fig, 2 tab, 16 ref.

Descriptors: *Toxicity, *Rainbow trout, *Carp, Chemical analysis, Chemical properties, Fish physiology, Animal metabolism, Animal pathology, Phenols, Organic compounds, Cytological studies, Detergents, *Tissue analysis, *Gills.

The organs and tissues of fishes intoxicated by non-ionogenic tensides on the basis of ethoxyl adducts of isononylphenols (Slovafol 905, 909, 915) were subjected to histopathological examination. The worst changes were found in the respiratory tract of the fishes. Pronounced congestion was observed in the gill fringes and filaments. This condition was accompanied by atrophic damage to the respiratory epithelium. Circulatory disturbances were observed in almost all the organs and tissues studied. (Deal-EIS)
W79-05099

BEHAVIORAL TOXICOLOGY AND TELEOST FISH,
H. Marcucella, and C. I. Abramson.
In: The Behavior of Fish and Other Aquatic Animals, D. I. Mostofsky; ed., p. 33-77, 1978. 12 fig, 133 ref, Academic Press, New York.

Descriptors: *Toxicity, *Fish behavior, *Variability, Chemical wastes, Industrial wastes, Fish physiology, Animal behavior, Carp, Chemical properties, Biochemistry, Learning, Conditioning, Goldfish, Actinomycin, *Piracetam, *Scotophobin, *Ethanol, *Puromycin.

An examination of the fish learning literature has shown that a variety of responses can be either respondently or operantly conditioned and that a variety of chemicals affect the acquisition, retention, and maintenance of these responses. However, several limitations of the existing data are readily apparent. Although there are literally hundreds of studies examining learning phenomena in fish, most of these studies have provided only group data. Thus, much information is available about learning in the average fish of various species, but very little information is available as to whether individual fish behave in a similar manner. Substantial between-subject variability reported in many of these experiments further clouds the issue. The major pressing concern, then, for behavioral toxicologists is to obtain reliable and precise measures and control over the behavior of individual fish for extended periods of time. Such control would provide behavioral toxicologists with a very sensitive yardstick against which to measure both the transient and long-term effects of most chemical pollutants. Once such information is obtained, ecologists and environmentalists will be able to objectively determine acceptable pollution levels, i.e., levels that will minimize the possibility of economic hardship and maximize that of fish survival. (Deal-EIS)
W79-05100

EFFECT OF THERMAL INCREASES OF SHORT DURATION ON SURVIVAL OF EUPHAUSIA PACIFICA,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
D. R. Craddock.
Fishery Bulletin, Vol. 76, No. 4, p. 895-900, 1979. 2 fig, 1 tab, 7 ref.

Descriptors: *Water temperature, *Heat resistance, Entrainment, *Zooplankton, Fish food organisms, Cooling waters, Intakes, Mortality, Thermal powerplants, Thermal pollution, Seasonal, Distribution patterns, *Euphausiids, *Euphausia, Acclimation.

Thermal conditions encountered in a cooling system were simulated to determine the temperature increases that E. pacifica could resist for short periods (15 and 30 min.). Data from this study indicate that even a short passage time through a condenser (15 min) at temperatures of 23-24C could kill from 11 to 53% of the euphausiids by thermal causes alone. The added loss due to abrasion, pressure, and toxic substances is unknown. To minimize damage to the euphausiid populations, condenser cooling system intakes should be located deep enough to take advantage of the coldest cooling water available to minimize temperatures in the system. A very deep intake (just below 100m) would probably minimize the entrainment of euphausiids. (Deal-EIS)
W79-05101

EXTREME TEMPERATURE TOLERANCE OF PALAEMON SERRATUS (PENNANT): INFLUENCE OF SIZE AND ACCLIMATION) TOLERANCE AUX TEMPERATURES EXTREMES DE PALAEMON SERRATUS (PENNANT): INFLUENCE DE LA TAILLE ET DE L'ACCLIMATATION,
Ecole Pratique des Hautes Etudes, Paris (France). Lab. de Biochimie et Ecologie des Invertebres Marins; and Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
P. Richard.
Journal of Experimental Marine Biology and Ecology, Vol. 35, p 137-146, 1978. 2 fig, 1 tab, 24 ref.

Descriptors: *Water temperature, *Cold resistance, *Heat resistance, Animal physiology, Animal metabolism, Size, Toxicity, Mortality, Seasonal, Migration, Animal behavior, Shrimp, Crustaceans, Commercial shellfish, Acclimation, Survival.

Prawns of different body sizes (from 2-6cm) acclimated at four different temperatures (13, 17, 21, and 25C), were tested for their tolerance of extreme high and low temperatures. Time-temperature curves based on 50% survival show an increase in low temperature tolerance and a decline in high temperature tolerance with increasing body size. The upper and lower lethal temperatures of the different size groups tested for each acclimation temperature are very similar, especially for extreme high temperatures. Acclimation has a much more pronounced effect than body size on tolerance of extreme temperatures. Prawns acclimated at low temperatures are more resistant to extremely low temperatures, while acclimation to high temperatures increases survival at extreme high temperatures. In some size groups for which acclimation temperature is very close to the limit no advantage is gained by acclimation. Acclimation at 21C appears to ensure the highest relative resistance of P. serratus to extreme high temperature. Seasonal distribution and migratory behaviour are discussed in relation to these results. It appears that these phenomena cannot be entirely explained by tolerance of extreme temperatures. (Deal-EIS)
W79-05102

THE LAKE WASHINGTON ECOSYSTEM: THE PERSPECTIVE FROM THE FISH COMMUNITY PRODUCTION AND FORAGE BASE,
Washington Univ., Seattle. Coll. of Fisheries.
D. M. Eggers, H. W. Bartoo, M. A. Rickard, R. E. Nelson, and R. C. Wissman.
Journal of the Fisheries Research Board of Canada, Vol. 35, p 1553-1571, 1978. 9 fig, 7 tab, 78 ref.

Descriptors: *Food chains, *Fish populations, *Domestic wastes, Ecosystems, Eutrophication, Predation, Herbivores, Zooplankton, Sculpins, Mortality, Growth stages, Daphnia, Trophic level, Productivity, Detritus, Benthic fauna, Growth rates, Sockeye salmon, Perches, Yellow perch, *Bottom feeders, *Squawfish, *Neomysis, Lake Washington, Washington.

In Lake Washington, fish production through detritus-based food chains is substantially greater than fish production through the grazing food chain. The lack of significant grazing by fish on the zooplankton is a consequence of both piscivore predation and conditions in the planktivore spawning environment. At low planktivore abundance, squawfish may switch to benthos feeding, exploiting the abundant prickly sculpin. At high planktivore abundance, squawfish feed more heavily on planktivores. Thus, even when reproductive success of planktivores is good, swamping of the squawfish population does not occur and depensatory mortality due to squawfish predation prevents planktivore abundance from increasing to the point where zooplankton resource depletion would occur. Benthic-littoral species are vulnerable to predation essentially only as larva and juveniles. They avoid predation by occupying littoral and epibenthic refugia. Recruitment to the adult population from these refugia may be sufficient to account for the greater rate of benthos exploitation by fish relative to the rate of zooplankton exploitation by fish. Neomysis is an important component of the Lake Washington fish production, since potentially Neomysis is a regulating agent on the zooplankton, and reduction in Neomysis predation on zooplankton, due to decreasing abundance and a deeper vertical distribution, may be partly responsible for the recent reappearance of Daphnia. The response of the fish community to trophic changes in Lake Washington has been slight. No consistent trends in the growth of fish utilizing zooplankton were observed. (Deal-EIS)
W79-05103

VIBRIO CHOLERAE, VIBRIO PARAHAEMOLYTICUS, AND OTHER VIBRIOS: OCCURRENCE AND DISTRIBUTION IN CHESAPEAKE BAY,
Maryland Univ., College Park. Dept. of Microbiology.
R. R. Colwell, J. Kaper, and S. W. Joseph.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A054 681, Price code: A02 in paper copy, A01 in microfiche. Science, Vol. 198, 1977. p 394-396, 1 fig, 1 tab, 24 ref.

Descriptors: *Pathogenic bacteria, *Public health, *Chesapeake Bay, Enteric bacteria, Bacteria, Spatial distribution, Temporal distribution, Toxicity, Toxins, Epidemics, Human diseases, Water quality, Water analysis, Epidemiology, *Vibrio.

Vibrio cholerae was isolated at several locations in Chesapeake Bay in fall 1976 and spring 1977. Strains induced fluid accumulation in rabbit ileal loops and related vibrios show a spatial and temporal distribution characteristic of Vibrio species in an estuary. The Vibrio cholerae strains isolated from Chesapeake Bay represent serotypes other than O-group I - that is, so-called non-agglutinable vibrios and are not recognized as a serious epidemic threat, although they have caused cholera-like diarrhea sporadically. (Deal-EIS)
W79-05104

INFLUENCE OF DILUTION WATER ON THE TOXICITY OF KRAFT PULP AND PAPER MILL EFFLUENT, INCLUDING MECHANISMS OF EFFECT,
British Columbia Research Council, Vancouver. Div. of Applied Biology.
For primary bibliographic entry see Field 5A.
W79-05105

TOXICITY OF COPPER TO CUTTHROAT TROUT (SALMO CLARKI) UNDER DIFFERENT CONDITIONS OF ALKALINITY, PH, AND HARDNESS,
Maine Univ. at Farmington. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W79-05107

TROPHIC LEVEL ACCUMULATION OF HEAVY METALS IN A COAL ASH BASIN DRAINAGE SYSTEM,
Texas Univ. Health Science Center at Houston. School of Public Health.
For primary bibliographic entry see Field 5A.
W79-05108

THE USE OF SPECIES ABUNDANCE ESTIMATES IN MARINE BENTHIC STUDIES,
Maine Univ., Walpole. Ira C. Darling Center for Research, Teaching and Service.
For primary bibliographic entry see Field 5A.
W79-05109

A BIOASSAY LABORATORY BOAT WITH COMPARISONS OF CENTRAL VS. BOAT LABORATORY BIOASSAY EVALUATIONS,
Academy of Natural Sciences of Philadelphia, PA. Div. of Limnology and Ecology.
For primary bibliographic entry see Field 5A.
W79-05111

METHODS FOR DETERMINING THE OXYGEN CONSUMPTION OF A FISH UNDER CONDITIONS OF AQUATIC SEMI-CONFINEMENT (METHODES DE DETERMINATION DE LA CONSOMMATION D'OXYGENE D'UN POISSON DANS LES CONDITIONS DU SEMI-CONFINEMENT AQUATIQUE),
Amiens Univ. (France). Lab. de Physiologie.
For primary bibliographic entry see Field 5A.
W79-05112

MERCURY AND SELENIUM IN BLUE MARLIN, MAKAIRA NIGRICANS, FROM THE HAWAIIAN ISLANDS,
National Marine Fisheries Service, Honolulu, HI. Southwest Fisheries Center.
C. D. Shultz, and B. M. Ito.
Fishery Bulletin, Vol. 76, No. 4, p 872-879, 1979. 6 fig. 2 tab, 18 ref.

Descriptors: *Mercury, *Chemical analysis, Hawaiian Islands, Sport fish, Spectrophotometry, Heavy metals, Biochemistry, Proteins, Path of pollutants, Food chains, Animal metabolism, Fish physiology, *Tuna, *Blue marlin, *Tissue analysis, *Selenium, *Organic mercury, *Methylmercury, *Bioaccumulation.

The presence of selenium in tuna, a principal food item of marlin, indicates that it should also be present in marlin from the Hawaiian Islands. For this report, nine tissues from blue marlin were analyzed for selenium, total mercury, and organic mercury. Average total mercury and selenium values were greatest in kidney (26.33 mg/kg Hg, 23.42 mg/kg Se) and least in blood (0.18 mg/kg Hg, 1.29 mg/kg Se) and gill (0.32 mg/kg Hg, 1.29 mg/kg Se). Average methyl mercury was highest in muscle (0.40 mg/kg) and lowest in blood (0.04 mg/kg) and gill (0.06 mg/kg). The percentage of organic to total mercury ranged from 1% in kidney to 27% in gonad. The molar ratio of mercury to selenium ranged from 0.06 in blood to 0.62 in muscle. The data clearly demonstrate that methyl mercury concentrations are low relative to total mercury in blue marlin. (Deal-EIS)
W79-05113

THE MESA PUGET SOUND PROJECT, SEATTLE, WASHINGTON. FISCAL YEAR 1977 - ANNUAL REPORT.
National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.
NOAA/ERL Marine Ecosystems Analysis Program Report, November 1978. 21 p. 1 fig, 28 ref, 3 append.

Descriptors: *Environmental effects, *Ecosystems, *Water quality, Water pollution effects, Resources development, Washington, Puget Sound(WA), Annual reports.

The Puget Sound Project is planned to develop an understanding of the environmental impact of human actions upon regional marine ecosystems and to predict the ecological consequences of these actions. Wastewater disposal and energy-related activities are significant in the region and are receiving special attention. Project planning currently is oriented towards critical contaminants introduced into the system by human activity. The project design concept is multidisciplinary ecosystem research. It emphasizes research efforts to increase knowledge of the kinds and degree of environmental impacts resulting from contaminant loading, the cause of these impacts, the dynamic processes influencing the fates and effects of contaminants, and the possible actions that would minimize or eliminate undesirable effects. (NOAA)
W79-05115

MESA NEW YORK LIGHT PROJECT ANNUAL REPORT FOR FISCAL YEAR 1977.
National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.
For primary bibliographic entry see Field 5B.
W79-05116

GROUND-WATER POLLUTION--A STATUS REPORT,
Illinois State Geological Survey, Urbana.
D. E. Lindorff.
Ground Water, Vol. 17, No. 1, p 9-17, January-February 1979. 3 fig, 2 tab, 34 ref.

Descriptors: *Groundwater, *Water pollution, *Hydrogeology, Regulation, Industrial wastes, Water supply, Water pollution control, Pollution abatement, Waste disposal, Landfills, Contamination impacts.

More than 170 case histories of subsurface contamination or pollution were studied to evaluate the effectiveness of remedial action in different geologic environments. The case studies indicated that the severity and extent of groundwater contamination is determined by (1) the hydrogeologic setting, (2) the nature of the contaminant, and (3) the effectiveness of regulatory action. Industrial wastes are the most common sources of groundwater contamination. The most serious incidents are those that pollute or threaten water supplies and those that cause a fire or explosion. Once groundwater is contaminated, remedial action is time consuming and expensive. Each incident must be handled as a separate problem. Although prompt action is essential to limit contamination and minimize remedial action, no strategies have been established for rapid response to contamination or pollution problems. Groundwater contamination will continue, but its impact can be reduced. The role of hydrogeologists in regulatory agencies should be strengthened to provide proper evaluation of potential sources of contamination and to aid in remedial action when groundwater is contaminated. Cooperative efforts to develop strategies will ensure proper handling of future emergencies. (Visocky-ISWS)
W79-05120

GROUND-WATER POLLUTION--AN IMMINENT DISASTER,
Ohio State Univ., Columbus. Dept. of Geology and Mineralogy.
W. A. Pettyjohn.
Ground Water, Vol. 17 No. 1, p 18-24, January-February 1979. 6 fig, 19 ref.

Descriptors: *Groundwater, *Water pollution, *Ohio, *New York, *Oregon, Water pollution control, Industrial wastes, Landfills, Leachate, Hydrogeology, Water pollution sources, Toxins, Chemical, Waste disposal, Water supply, Pollution costs, Case studies.

The significance of groundwater pollution depends on perspective. To those individuals who are directly affected, it is an imminent disaster. Once contaminated, groundwater may remain in an unusable or even hazardous condition for decades or even centuries as illustrated by situations in central Ohio, New York, London, and many other places. All polluted water can be treated to make it potable, but the expense may far exceed the resources of the individual homeowner. (Visocky-ISWS)
W79-05121

TRANSPORTATION OF ADULT AMERICAN SHAD PAST DAMS ON THE CONNECTICUT RIVER, MASSACHUSETTS, 1973-76,
Fish & Wildlife Service, Hadley, MA.
J. B. Layzer.
The Progressive Fish Culturist, Vol. 41, No. 1, p 7-9, 1979, 3 tab, 6 ref.

Descriptors: *Massachusetts, *Shad, *Holyoke Dam, *Turners Falls Dam, *Fish transport, Fish migration, Mortality, Anadramous fish, *Differential mortality, Trucking, Alosa, Fish sex, Adult fish, Fish passages, Fishing gear, Female mortality.

Adult American shad (Alosa sapidissima) were obtained from the Holyoke Dam fish lift, Massachusetts, and transported 68 km by truck to the pool above the Turners Falls Dam. From 1973 to 1976, 6373 shad were transported; average annual mortality was 25%. Mortality of trucked fish was related to river temperature and the number of fish transported at any one time. During trucking a differential mortality occurred between sexes: 2.4 times more females died than males. (Katz-EIS)
W79-05174

EFFECT OF PHENOL UPON ACTIVATION AND FERTILIZATION ABILITY OF RAINBOW TROUT SPERMATOZOA (SALMO GAIRDNERI RICH.) (IN POLISH),
Institute of Ichthyology, Szczecin (Poland).
L. Tomasik, and K. Radziun.
Zeszyty Naukowe Akademii Rolniczej W Szczecinie, Vol. 63, p 25-30, 1977. 2 tab, 6 ref, English Summary.

Descriptors: *Phenols, *Fish reproduction, *Fish eggs, *Rainbow trout, Toxicity, Fertility, Embryonic growth stage, Chemical analysis, Cytological studies, Inhibition, Resistance, Absorption, Bioassay, Laboratory tests, *Spermatozoa.

Phenol aqueous concentrations ranging from 25 to 1500 mg/l were tested with regard to the spermatozoa activation and fertilization of Salmo gairdneri Rich. eggs. Concentrations up to 800 mg/l proved to exert no adverse effects upon the spermatozoa activation. However, the period of oscillatory movements is shortened with phenol concentrations from 500 mg/l upwards. Concentrations up to 500 mg/l show no detrimental effects upon percentage of fertilized eggs. Following a further increase in the phenol concentration the fertilization is observed to be strongly retarded up to a complete cessation of the process at 1300 mg/l. Considering known data on the phenol resistance of embryos, newly hatched young, and adult individuals, gametes are found to be the most resistant. (Deal-EIS)
W79-05176

EFFECT OF DBS DETERGENT ON ACTIVITY OF SOME ENZYMES OF YOUNG CARP (CYPRINUS CARPIO L.) BRAIN, GILLS AND SERUM,
Medical Academy, Gdansk (Poland). Inst. of Medical Biology.
M. K. Jurkowski.
Acta Ichthyologica et Piscatoria, Vol. 7, No. 2, p 47-53, 1977. 3 fig, 2tab, 13 ref.

Descriptors: *Detergents, *Sulfonates, *Enzymes, *Carp, Toxicity, Biochemistry, Proteins, Chemical analysis, Path of pollutants, Fish physiology, Animal metabolism, Biological membranes, Organic compounds, *DBS, *Tissue analysis, *ATP.

Effects of DBS (sodium dodecyl-benzene-sulphonate) on the activity of ATP-ases and cholinesterases of autumn young carp brain, gills, and serum were studied. On the second day of exposure the brain ATP-ases activity was found to increase by about 120%. On the twelth day, the activity of these enzymes dropped by about 30% as compared to the control. Blood serum cholinesterases exhibited a constant increase in their activity throughout the experimental period. (Deal-EIS)
W79-05177

FINGERLING AMERICAN SHAD: EFFECT OF VALIUM, MS-222, AND SODIUM CHLORIDE ON HANDLING MORTALITY,
Georgia Univ., Savannah. Coastal Plain Station.
For primary bibliographic entry see Field 5B.
W79-05179

PALAEMONID SHRIMP, MACROBRACHIUM AMAZONICUM: EFFECTS OF SALINITY AND TEMPERATURE ON SURVIVAL,
Texas Parks and Wildlife Dept., Ingram. Heart of Hills Fisheries Research Station.
For primary bibliographic entry see Field 5B.
W79-05181

CHANGES IN THE SPECIES COMPOSITION OF FISH IN THE RIVER LOT,
Toulouse-3 Univ. (France). Lab. d'Hydrobiologie.
For primary bibliographic entry see Field 5B.

W79-05184

ATLANTIC SALMON EMBRYOS AND FRY: EFFECTS OF VARIOUS INCUBATION AND REARING METHODS ON HATCHERY SURVIVAL AND GROWTH,
Bureau of Sport Fisheries and Wildlife, Cortland, NY. Tunison Lab. of Fish Nutrition.
K. A. Leon, and W. A. Bonney.
The Progressive Fish Culturist, Vol. 41, No. 1, p 20-25, 1979. 3 tab, 3 fig, 6 ref.

Descriptors: *Methodology, *Aquiculture, Laboratory tests, *Laboratory equipment, Freshwater fish, *Atlantic Salmon, Fish hatcheries, Fish eggs, Juvenile fish, Incubation methods, Rearing methods, Water quality, Hatchery survival, Hatchery growth.

Significantly heavier fry of Atlantic salmon (Salmo salar) and greatly reduced mortality apparently resulted from the use of matrix substrates during egg incubation and alevin development. Salmon fry produced by this method fed readily and did not have the constricted yolk sacs that commonly occur when conventional rearing methods are used. (Katz-EIS)
W79-05187

THE ECOLOGICAL IMPACT ON AND NEAR SHORES BY THE AMOCO CADIZ OIL SPILL,
Universite de Bretagne-Occidentale, Brest (France). Inst. d'Etudes Marine.
For primary bibliographic entry see Field 5B.
W79-05190

SURVIVAL OF SALMON SMOLTS IN SEA WATER AFTER EXPOSURE TO AIR-SUPERSATURATED WATER,
Corvallis Environmental Protection Agency, OR. Western Fish Toxicology Station.
For primary bibliographic entry see Field 5B.
W79-05191

BIRDS OILED DURING THE AMOCO CADIZ INCIDENT - AN INTERIM REPORT,
Royal Society for the Protection of Birds Sandy (England).
For primary bibliographic entry see Field 5B.
W79-05192

NOTES ON THE CONDITION IN SEPTEMBER 1978 OF SOME INTERTIDAL SANDS POLLUTED BY AMOCO CADIZ OIL,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 5B.
W79-05193

PRELIMINARY OBSERVATIONS ON POLLUTION OF THE SEA BED AND DISTURBANCE OF SUB-LITTORAL COMMUNITIES IN NORTHERN BRITTANY BY OIL FROM THE AMOCO CADIZ,
Station Biologique de Roscoff (France).
For primary bibliographic entry see Field 5B.
W79-05194

THE AMOCO CADIZ OIL SPILL. A SUMMARY OF OBSERVATIONS MADE BY U.S. SCIENTISTS 23 MARCH-10 MAY, 1978,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
D. A. Wolfe.
Marine Pollution Bulletin, Vol. 9, No. 11, p 288-292, 1978. 6 fig, 3 ref.

Descriptors: *Oil, *Oil spills, *Amoco Cadiz, *Water pollution effects, Littoral, Beaches, Sediments, Seawater, *On-site-investigations, NOAA/EPA Report, Wind/Wave/Oil interactions, Currents(Water), Ocean currents, Ocean waves, Beach processes, Oiled sands, Waste treatment, Clean-up activities, Marine algae, Gas chromatography.

This paper summarizes briefly the observations made by a team of United States scientists during the two months immediately after the grounding of the Amoco Cadiz. Most of the information has been abstracted from the NOAA/EPA preliminary scientific report (Hess, 1978) which provides a more complete account of objectives and results to date. It is hoped that maximum use may be derived from a study of the effects of the spill. Oceanographic and meteorologic processes, beach processes, clean up activities and chemical observations are reported. (Katz-EIS)
W79-05195

TOXICITY OF RESIDUAL CHLORINE COMPOUNDS TO AQUATIC ORGANISMS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5B.
W79-05197

PREDICTING NIGHTTIME DISSOLVED OXYGEN DECLINE IN PONDS USED FOR TILAPIA CULTURE,
Alabama Univ., Auburn. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 5B.
W79-05200

EVALUATION OF PH SHOCK ON HATCHERY-REARED RAINBOW TROUT,
Arizona Cooperative Fishery Unit, Tucson.
W. A. Witschi, and C. D. Ziebell.
The Progressive Fish Culturist, Vol. 41, No. 1, p. 3-5, 1979. 1 tab, 1 fig, 4 ref.

Descriptors: *Bioassay, *Mortality, Toxicity, *Hydrogen ion concentration, Rainbow trout, *Aquiculture, Fish hatchery, Hatchery-reared trout, pH shock, Fish management, Fish physiology, Arizona.

The effect of transferring hatchery-reared rainbow trout from water with a pH of 7.2 to water with pH's ranging from 8.5 to 10.0 was evaluated in 48-h tests. All fish survived in the control (pH 7.2) and at pH 8.5. Survival was 88% at pH 9.0, 68% at pH 9.5, and 0 at pH 10.0. After the 48-h exposure, the remaining test fish were fed their usual pelleted food. Trout in the control and those held at pH 8.5 fed well. Only a few of the fish held at pH 9.0, and none of those held at pH 9.5, fed. These data indicate that it is not advisable to stock rainbow trout reared in nearly neutral hatchery water into lakes with a pH of 9.0 or higher. (Katz-EIS)
W79-05202

EFFECTS OF CONTINUOUS ZINC EXPOSURE ON SOCKEYE SALMON DURING ADULT-TO-SMOLT FRESHWATER RESIDENCY,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
G. A. Chapman.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 828-836. 1978. 4 fig, 3 tab, 16 ref.

Descriptors: *Zinc, *Sockeye salmon, *Toxicity, Water quality standards, Mortality, Lethal limit, Embryonic growth stage, Fertility, Fecundity, Growth rates, Adaptation, Fish reproduction, Fish physiology, Chemical analysis, Heavy metals, Life history studies, *Survival.

This chronic zinc toxicity test with sockeye salmon consisted of a 3-mo adult exposure followed by an 18-mo exposure of embryonic through smolt stages. The zinc concentrations utilized were 30 to 112 ug/liter concentration was used for the embryo-to-smolt exposure period. These zinc concentrations produced no adverse effects on survival, fertility, fecundity, growth, or on the subsequent survival of smolts transferred to seawater. Exposure to 242 ug/liter produced sufficient acclimation to markedly decrease acute mortality at zinc levels lethal to unacclimated sockeye salmon juveniles. The 112-and 242-ug/liter concentrations were 0.15 and 0.32, respectively, of the 749-ug/liter, 96-h LC50 for the 8-mo-old sockeye salmon. An application factor relating 96-h LC50 and 'safe' concentrations of zinc to anadromous sockeye salmon in soft water appears to be > 0.15 and at least 15 times larger than the often recommended 0.01 application factor for zinc based on studies with other species. (Katz-EIS)
W79-05203

EFFECTS OF ELEVATED TEMPERATURE ON EARLY EMBRYONIC DEVELOPMENT OF THE TAUTOG, TAUTOGA ONITIS,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Lab.
B. L. Olla, and C. Samet.
Transaction of the American Fisheries Society, Vol. 107 No. 6, p. 820-824. 1978, 1 tab, 23 ref.

Descriptors: *Water temperature, *Fish reproduction, *Heat resistance, Embryonic growth stage, Animal pathology, Growth stages, Toxicity, Heated water, Spawning, Fish eggs, Mortality, Fish physiology, *Tautog, *Tautoga, *Teratogens, *Tissue analysis.

The effect of elevated temperature on early embryonic development of tautog was the subject of a study in which both spawning adults and developing eggs were exposed to similar temperatures. When incubation temperature was gradually raised from 20.0C, anatomical deformities, including stunted embryos and/or abnormal body curvatures, as well as increased mortality occurred between 24.2 and 26.3C. Normal development was evident after the temperature returned to 20.0C. (Deal-EIS)
W79-05204

THE RIOU-MORT A TRIBUTARY TO THE RIVER LOT POLLUTED BY HEAVY METALS. I. PRELIMINARY OBSERVATIONS ON THE CHEMISTRY AND BENTHIC ALGAE,
Toulouse-3 Univ. (France). Lab. d'Hydrobiologie.
For primary bibliographic entry see Field 5B.
W79-05206

ACUTE TOXICITY OF PERMETHRIN TO SEVERAL AQUATIC ANIMALS,
Louisiana State Univ., Baton Rouge. Fisheries Div.
A. L. Jolly Jr.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 825-827 1978. 1 tab, 13 ref.

Descriptors: *Pesticide toxicity, *Insecticides, *Crayfish, *Channel catfish, *Bass, *Frogs, Agricultural chemical, Toxicity, Pesticide residues, Livebearers, Commercial shellfish, Pesticide kinetics, Path of pollutants, *Permethrin, *Mosquitofish.

Acute toxicity tests were conducted on permethrin (Pounce(TRADEMARK)), a synthetic pyrethroid, by using 8-12- and 20-30-mm Louisiana red swamp crayfish (Procambarus clarkii), fry channel catfish (Ictalurus punctatus), fingerling largemouth bass (Micropterus salmoides), mosquitofish (Gambusia affinis), and bullfrog tadpoles (Rana catesbeiana). The 96-h LC50 values were 0.39, 0.62, 1.1, 8.5, 15.0, and 7.033 ug/liter, respectively. (Deal-EIS)
W79-05207

THE USE OF COPPEROXYCHLORIDE DURING LARVAL GROWTH AS A PREVENTATIVE MEASURE AGAINST THE SPREAD OF CILIATA-EXOPARASITES,
Warmwater Fish Hatchery (Hungary).
For primary bibliographic entry see Field 5B.
W79-05209

A MERCURY BUFFER FOR TOXICITY EXPERIMENTS WITH GREEN ALGAE,
Technische Hogeschool, Delft (Netherlands). Lab. of General and Technical Biology.
For primary bibliographic entry see Field 5A.
W79-05210

ASSESSMENT OF POTENTIAL INTERACTIONS OF MICROORGANISMS AND POLLUTANTS RESULTING FROM PETROLEUM DEVELOPMENT,
Louisville Univ., KY. Dept. of Biology.
R. M. Atlas.
In: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978. U.S. Department of Commerce Environmental Research Laboratories, Boulder, Colo. September 1978. p 40-49, 2 tab. 03-5-022-85.

Descriptors: *Biodegradation, *Oil spills, *Environmental effects, *Baseline studies, Resource development, Data collections, Microorganisms, Alaska, *Outer Continental Shelf, Petroleum hydrocarbons.

Samples were collected for microbiological studies in Lower Cook Inlet during April - May. Sediment-oil trays in Elson Lagoon were sampled during April. Under ice-oil cylinders were also recovered during April. Miniature oil spills were released under ice in April to develop prototypes for future oil under ice degradation experiments. The movement of the oil under the ice was filmed. Laboratory testing for taxonomic analyses of microbial isolates from the November Cook Inlet cruise has been completed. (Sinha-OEIS)
W79-05212

COASTAL MORPHOLOGY, OIL SPILL VULNERABILITY AND SEDIMENTOLOGY OF KOTZEBUE SOUND AND KODIAK ISLAND,
South Carolina Univ., Columbia. Dept. of Geology.
M. O. Hayes, and C. H. Ruby.
In: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978, U.S. Department of Commerce, Environmental Research Laboratories, Boulder, Colo. September 1978. p 50-53.

Descriptors: *Oil spills, *Sedimentology, *Environmental effects, Coasts, Resources development, Alaska, *Outer Continental Shelf, Coastal morphology.

The major emphasis of this project is to: evaluate present rates of change in coastal morphology, with particular emphasis on rates and patterns of man-induced changes, and locate areas where coastal morphology is likely to be changed by man's activities, if any. The relative susceptability of different coastal areas will be evaluated especially with regard to potential oil spill impacts. (Sinha-OEIS)
W79-05213

THE EFFECTS OF OIL ON TEMPERATURE REGULATION IN SEA OTTERS,
Scripps Institution of Oceanography, La Jolla, CA. Physiological Research Lab.
G. Kooyman, and D. Costa.
In: 'Environmental Assessment of the Alaskan Continental Shelf', Quarterly Reports of Principal Investigators for April - June 1978, U.S. Department of Commerce, Environmental Research Laboratories, Boulder, Colorado September 1978. p 66-69.

Descriptors: *Oil pollution, *Water pollution effects, *Otters, *Baseline studies, Temperature, Metabolism, Resources development, Alaska, *Outer Continental Shelf.

A significant amount of time has been spent preparing for the expedition to Prince William Sound, AK in July 1978. The objectives are to study: (1) energy requirements of normal sea otters at various water temperatures; (2) energy requirements of sea otters after oiling; (3) appropriate procedures for rehabilitating oiled sea otters; and (4) at sea behavior and energetics of sea otters. These objectives will provide a data base from which the assessment of any kind of oil contamination, or other activity which may alter the nature of the otter's food sources can be derived. In addition, relative to oil contamination the difficulties and costs of rehabilitating the oiled otters can be estimated. (Sinha-OEIS)
W79-05214

ACUTE AND CHRONIC TOXICITY, UPTAKE AND DEPURATION, AND SUBLETHAL METABOLIC RESPONSE OF ALASKAN MARINE ORGANISMS TO PETROLEUM HYDROCARBONS,
National Marine Fisheries Service, Auke Bay, AK. Northwest and Alaska Fisheries Center.
S. D. Rice, J. F. Karinen, and S. Korn.
Un: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978 U.S. Department of Commerce, Environmental Research Laboratories, Boulder, Colorado, p 70-79, September 1978.

Descriptors: *Oil pollution, *Water pollution effects, *Toxicity, *Salinity, Resources development, Environmental effects, Fish Shellfish, Alaska, *Outer Continental Shelf, *Aromatic hydrocarbons, Petroleum hydrocarbons.

New experiements were started in the April-June quarter and a study to determine effects of salinity on oil toxicity to several species was almost completed. Data collecting and experiments are on schedule, while data analysis, work-up, report writing, manuscript synthesis, etc. are progressing slowly. A major breakthrough occurred with the development of a new system to maintain stable concentrations of aromatic hydrocarbons in water. The system, which injects dissolved aromatics, can be used with any number of aromatics simultaneously. This will allow synthetic WSF tests and continuous-flow isotope uptake studies. (Sinha-OEIS).
W79-05215

SUBLETHAL EFFECTS OF PETROLEUM HYDROCARBONS AND TRACE METALS, INCLUDING BIOTRANSFORMATIONS, AS REFLECTED BY MORPHOLOGICAL, CHEMICAL, PHYSIOLOGICAL, PATHOLOGICAL AND BEHAVIORAL INDICES,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
D. C. Malins, E. H. Gruger, Jr., H. O. Hodgins, N. L. Karrick, and D. D. Weber.
In: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978, U.S. Department of Commerce, Environmental Research Laboratories, Boulder, Colorado, September 1978, p 82-99. 1 tab, 29 ref.

Descriptors: *Oil pollution, *Water pollution effects, *Environmental effects, Metals, Fish, Shellfish, Biology, Alaska, *Outer Continental Shelf, *Petroleum hydrocarbons, Sublethal effects, Biotransformations.

The response of marine organisms to environmental contaminants are reflected in numerous changes that are detectable at population and organismic levels, as well as at cellular and molecular levels. The general scope of this study is to evaluate effects caused by behavioral, physiological, pathological, morphological, and chemical changes in subarctic and arctic marine animals exposed to petroleum hydrocarbons and trace metals. (Sinha-OEIS)
W79-05216

THE INTERACTION OF OIL WITH SEA ICE,
Washington University, Seattle. Dept. of Oceanography.
S. Martin.
In: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978, U.S. Department of Commerce, Environmental Research Laboratories, Boulder, Colorado, September 1978, p 112-118. 3 fig.

Descriptors: *Oil pollution, *Water pollution effects, *Sea ice, *Oil spills, Resources development, Environmental effects, Baseline studies, Alaska, *Outer Continental Shelf, Pack ice, Petroleum.

A series of experiments on the interaction of pollutants and grease ice were carried out. It was found that when waves propagate into grease ice, that because of the non-linear viscosity of grease ice, the wave amplitude decays linearly, with the grease ice nature undergoing a transition from a liquid to a solid as the waves' amplitude becomes small. On one side of this transition, the waves propagate as water waves; on the other, they propagate as elastic waves. When oil is released into this wave-agitated ice, it accumulates at the liquid-solid transition. (Sinha-OEIS)
W79-05217

TRANSPORT MECHANISMS AND HYDROCARBON ADSORPTION PROPERTIES OF SUSPENDED MATTER IN LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. A. Feely, and G. J. Massoth.
In: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978, U.S. Department of Commerce, Environmental Research Laboratories, Boulder, Colorado, p 164-169, September 1978. 1 fig.

Descriptors: *Oil pollution, *Sediment transport, *Water pollution effects, Suspended solids, Resources development, Alaska, *Outer Continental Shelf, Hydrocarbons, Lower Cook Inlet.

The major objectives of the Lower Cook Inlet suspended matter program include: (1) determination of the seasonal variability of the vertical fluxes, the distribution, and the composition of suspended particulate matter in areas of contrasting sedimentation and productivity; (2) participation in an interdisciplinary study of the partitioning of several trace element species among their major reservoirs; and (3) investigation of the physical processes and mechanisms controlling the accommodation of petroleum hydrocarbons with respect to Lower Cook Inlet suspended matter. (Sinha-OEIS)
W79-05218

DISTRIBUTION AND DYNAMICS OF HEAVY METALS IN ALASKAN SHELF ENVIRONMENTS SUBJECT TO OIL DEVELOPMENT,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. C. Burrell.
In: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978, US Department of Commerce, Environmental Research Laboratories, Boulder, Colorado, p 170-200, September 1978. 16 fig, 6 tab. 03-5-022-56.

Descriptors: *Oil pollution, *Heavy metals, *Toxicity, *Water pollution effects, Resources development, Biota, Sediments, Environmental effects, Baseline studies, Alaska, *Outer continental Shelf.

Natural pathways of potentially toxic heavy metals to and through Alaskan Shelf and coastal marine biota (with emphasis on commercially important benthic species) are researched to determine and predict changes likely to result from oil industry activity in this marine zone. Ancillary components of this work include: (1) characterizing the heavy metal inventories of the water, sediment and indigenous biota in those geographic areas for which no back ground data exist; (2) determining non-biological pathways (rates and routes under both natural and stressed conditions) of the heavy metals as these affect the availability of metals to the organisms; and (3) toxicity effects of selected heavy metals to animals which are of major commercial importance under Alaskan environmental conditions. (Sinha-OEIS)
W79-05219

STUDY OF MICROBIAL ACTIVITY AND CRUDE OIL-MICROBIAL INTERACTIONS IN THE WATERS AND SEDIMENTS OF COOK INLET AND THE BEAUFORT SEA,

Oregon State Univ., Corvallis. Dept. of Microbiology.
R. P. Griffiths, and R. Y. Morita.

In: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978, U.S. Department of Commerce, Environmental Research Laboratories, Boulder, Colorado, p 204-246, September 1978. 7 fig, 18 tab. 03-5-022-68.

Descriptors: *Oil pollution, *Water pollution effects, Microorganisms, Sediments, Environmental effects, Alaska, *Outer Continental Shelf, Beaufort Sea.

Studies of relative microbial activity and respiration (mineralization) ratios of natural microbial populations found in water and sediment samples are continued. Areas which are shown to have particularly high activity should be those in which crude oil will be degraded at higher rates. These areas probably support the highest overall biological activity and as such may be the areas which will be most affected by the presence of crude oil. These data may also be used in the future to estimate the degree of perturbation caused by chronic crude oil input. The studies include crude oil effects on microbial function as measured by uptake and respiration characteristics using several labeled compounds. They also include the study of nitrogen fixation and the effects of crude oil on this process. (Sinha-OEIS)
W79-05220

INFLUENCE OF PETROLEUM ON EGG FORMATION AND EMBRYONIC DEVELOPMENT IN SEABIRDS,

Point Reyes Bird Observatory, Stinson Beach, CA.
D. G. Ainley, C. R. Grau, and S. H. Morrell.

In: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978. U.S. Department of Commerce, Environmental Research Laboratories, Boulder, CO, p 552-557, September 1978.

Descriptors: *Oil pollution, *Water pollution effects, *Birds, *Embryonic growth stage, Baseline studies, Environmental effects, Resources development, Alaska, Testing, *Outer Continental Shelf, Petroleum.

The most fundamental and significant observation from this quarter's work is that egg laying in Cassin's auklets is not eliminated by ingestion of 1 gram of either Prudhoe Bay crude oil or Bunker C oil. This, however, may have little influence on eventual reproductive success in oiled seabirds if oil ingestion with a meal during egg formation causes eggs not to hatch. Apparently oil ingestion by a bird during yolk formation causes changes in the yolk which can be identified by chemical and physical methods. Eggs from ducks fed 4 different crude oils were all identified as eggs from birds which had ingested oil by examining spots of extracts of yolk on thin layer plate under UV light. UV spectrophotometric scans of similar but more purified extracts shows a shoulder at 258 nm. These data indicate that fluorescent, UV absorbent compounds are present in yolks of birds fed oil. Levy (1970) has stated that absorbance at 256 nm should be considered evidence of the presence of petroleum compounds. If this is true it appears likely that the UV absorbing fluorescent compound(s) found in oil yolks are of oil origin and not biogenic or induced compounds found after oil ingestion. (Sinha - OEIS)
W79-05221

RESEARCH TO DETERMINE THE ACCUMULATION OF ORGANIC CONSTITUENTS AND HEAVY METALS FROM PETROLEUM-IMPACTED SEDIMENTS BY MARINE DETRITIVORES OF THE ALASKAN CONTINENTAL SHELF,

Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
J. S. Anderson, J. M. Augenfeld, E. A. Crecelius, and R. Riley.

21 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978, U.S. Department of Commerce, Environmental Research Laboratories, Boulder, Colorado, September 1978, p 581-596. 1 fig, 5 tab, 7 ref. No. 2311102778.

Descriptors: *Oil pollution, *Water pollution effects, *Sediments, Heavy metals, Biota, Alaska, Testing, Resource development, *Outer Continental shelf, Detritivores.

An experiment was conducted to determine the fate of specific hydrocarbons in oil-impacted sediments, in terms of their distribution in association with sediment particles, in interstitial and surface water, and in detritivorous organisms, as well as their chemical alteration into polar metabolites. For this purpose, 190 Macoma inquinata, a detritus-feeding clam, and 100 kg sediment were collected from the low intertidal zone in an area of coarse sand mixed with fine gravel. The results summarized in tabular form indicate that the solubility of heavier hydrocarbons in interstitial water is inversely related to their molecular weight. The interstitial concentration of phenenthrene rises to a peak after 15 days at a level equivalent to 7.2% of the initial measured sediment concentration. In later measurements it declined to about one third of this value. The concentration in the surface water overlying the sediment was an order of magnitude less than that in the interstitial water, but it increased and decreased in step with the latter. (Sinha -OEIS)
W79-05222

ACTIVITY-DIRECTED FRACTIONATION OF PETROLEUM SAMPLES,

Battelle Columbus Labs., OH.
J. S. Warner, and J. W. Anderson.

In: 'Environmental Assessment of the Alaskan Continental Shelf' Quarterly Reports of Principal Investigators for April - June 1978. U.S. Department of Commerce, Environmental Research Laboratories, Boulder, CO. 2 tab, p 642-651, September 1978.

Descriptors: *Oil pollution, *Water pollution effects, *Toxicity, Weathering, Biota, Environmental effects, *Outer Continental shelf, *Weathered oil, Crude oil, Mutagenicity.

This research program is an effort to determine the potential environmental hazard of the nonhydrocarbon portions of weathered oil. The program involves fractionation of both fresh and weathered Prudhoe Bay crude oil, subfractionation of primarily nonhydrocarbon fractions, biological screening of fractions to assess their toxicity and mutagenicity, and chemical characterization of any highly active fractions. Solvent studies have indicated that cyclopentanone and cyclopentanol are solvents of choice for completely dissolving crude oil and permitting it to be dispersed in water with a minimum of toxicity contributed by the solvent. The Ames mutagenicity assay, prescreen confluency assay for mammalian cell toxicity, and in vivo bioassays using brine shrimp and mysids were used to screen cyclopentanone solutions of reference compounds, crude oil, and crude oil fractions. Although the reference compounds were active, the design of the assays to accommodate highly involuble components prevented much biological activity from crude oil and its fractions. (Sinha -OEIS)
W79-05223

THE TRANSPORT AND BEHAVIOR OF OIL SPILLED IN AND UNDER SEA ICE,

Flow Research Co., Kent, WA.
M. D. Coon, and R. S. Pritchard.

In: 'Environmental Assessment of the Alaskan Continental Shelf,' Quarterly Reports of Principal Investigators for April - June 1978 U.S. Department of Commerce, Environmental Research Laboratories, Boulder, CO. p 777-779, September 1978.

Descriptors: *Oil spills, *Oil pollution, *Sea ice, *Water pollution effects, Resources development, Environmental effects, Alaska, *Outer Continental Shelf.

The goal of the proposed work is to determine the locations to which oil spilled in or under the ice cover near Prudhoe Bay, Alaska, would be transported and to determine the behavior of the oil as the ice cover moves and deforms. Two separate tasks are identified. First, to determine a range of velocity fields which might be taken by the ice cover on the continental shelves of the Beaufort and Chukchi Seas by numerical modeling and synthesis of the results with manned and drifting station data. These velocity fields shall represent the climatological mean (or most probable) and extremes. As part of this task major breakouts of the ice from the Chukchi into the northern Bering Sea shall be considered. The second task is for the overall management of the program as well as possible to determine the likely trajectory and destination points for oil in several hypothetical scenarios by combining the relevant information obtained. (Sinha -OEIS)
W79-05224

AN ANNUAL PHYTOPLANKTON STUDY IN COASTAL WATERS OFF EASTERN LONG ISLAND (BLOCK ISLAND SOUND),

New York Ocean Science Lab., Montauk.
R. D. Staker, and S. F. Bruno.

Botanica Marina, Vol. 21, No. 7, p 439-449, October 1978. 6 fig, 4 tab, 19 ref.

Descriptors: *Phytoplankton, *Block Island Sound(New York), *Ecology, *Cycles, *Dominant organisms, *Species composition, Diatoms, Skeletonema costatum, Thalassiosira nordenskioldii, Ceratium tripos, Chrysophyta, Pyrrophyta, New York, Long Island(NY), Annual algae, Coasts, Atlantic Ocean, Oceans, Nutrients, Limiting factors, Nitrates, Phosphorus, Dissolved oxygen, Abundance, Species diversity, Biomass, Floral lists.

Ninety-three bacilariophyceae species and 25 phyrrophyta species were identified in a survey of planktonic algae in neritic waters of Block Island Sound off eastern Long Island, New York. Skeletonema costatum had the highest cell count but was surpassed by Thalassiosira nordenskiolii and Ceratium tripos in biomass. Water was sampled semimonthly October 1975-November 1976; seawater temperature ranged 1-22C, salinity 27.7-31.7%, and pH averaged 7.83. Oxygen readings were usually greater than 5.0 ml/l (mean 5.91 ml/l), and average vitamin B12 levels were similar to other coastal waters (mean 1.83 ng/l; maximum 10.6 ng/l). While phosphorus levels appeared satisfactory for phytoplankton growth (reactive phosphorus levels never fell below 0.1 microgram-atoms/liter), nitrate-nitrogen values may have been close to limiting from late May to early July. Most nitrate-nitrogen levels fell drastically mid-January to mid-February, while phytoplankton reached a peak between mid-January and mid-March, contrary to conditions observed in eastern Long Island Sound. The dominance among diatoms of S. costatum during bloom periods agrees with previous studies in Long Island and Block Island Sounds, but its relative importance appeared to be less in the present study. A complete species list is given and species diversity was calculated by the Shannon Index. (Lynch-Wisconsin)
W79-05231

KANSAS RIVER LIMNOLOGY: SEASONAL VARIATIONS IN PHOTOSYNTHETIC PRODUCTION AND HEAVY METAL ACCUMULATION BY AQUATIC INSECTS,

Kansas Water Resources Research Inst., Manhattan.
G. R. Marzolf.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 604, Price codes: A04 in paper copy, A01 in microfiche. Contribution No 207, Project Completion Report, January 1979. 56 p, 4 fig, 2 tab, 20 ref. OWRT A-078-KAN(1). 14-34-0001-7035.

Descriptors: *Aquatic insects, *Heavy metals, *Primary production, Plankton, Algae, Eutrophication, Photosynthesis.

Maximum photosynthetic production in the Kansas River is estimated at 30 gm C m-2 day-1. This rate is extraordinarily high, exceeding the maximum integral values for the most eutrophic lakes in the world by six fold. The maximum rate of production by the planktonic component is 3 times higher than the most eutrophic lakes at approximately 15 gm C m-2 day-1. The total community production estimate carries with it the potential for error associated with the diffusion estimate, but the error affects precision not accuracy and the planktonic production estimate does not contain this error. The analysis of diel oxygen curves from the open stream to evaluate photosynthetic production involves the estimation of reaeration coefficients. As a practical matter this has been a difficult estimation to make. The measurement of planktonic algal activity can be done in enclosures which preclude the need for a diffusion correction, and since the river is well mixed by turbulent flow the associated sampling errors are low and easily evaluated. The concentration of metals in aquatic insects is quantifiable with X-ray fluorescence instrumentation. The sampling error is too great to discern differences in metal concentrations between times of the year or between stations on the river. There are, however, clear differneces between insect species.
W79-05234

NON-POINT WATER QUALITY MODELING IN WILDLAND MANAGEMENT: A STATE-OF-THE-ART ASSESSMENT. (VOLUME I. TEXT).
Forest Service, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 280, Price codes: A08 in paper copy, A01 in microfiche. Final Report. Prepared for Environmental Research Lab, Athens, Georgia, April 1977. 145 p, 2 fig, 14 tab, 360 ref.

Descriptors: *Forestry, *Water quality, *Model studies, *Wildland management, *Nonpoint pollution, *Simulation analysis, Runoff, Hydrology, Erosion, Planning, Watershed studies, Evaluation, Methodology, Inventories, Prediction, Systems analysis, Effects.

Predicting nonpoint pollution from wildland environments is evaluated in three main areas: management activity/pollutant relationship; predictive model review and state-of-the-art assessment; and an inventory of 176 wildland watersheds suitable for model validation and development. Nonpoint pollution is directly related to the time and space variability of the hydrologic cycle and existing terrain, and the relationship is site-dependent. Impact of sedimentation from site disturbance is the most common. Predictive models for nonpoint pollutant loading relating spatial variability and diversity of terrain to management activities are the most important in evaluating the potential on-site impact of planned wildland management activities. Few nonpoint loading models exist. The state-of-the-art is represented by process simulation models, not yet extensively used for field application. Their use will require validation and simplification. Modular model development will have the maximum utility in the decision process. The state-of-the-art at the field level lags that of research and is represented by regional regression models and analytical procedures. Watersheds available for nonpoint model validation and testing do not have long data records (less than 10 years), except on streamflow and to a lesser extent suspended sediment. (See also W79-05270) (Bell-Graf-Cornell)
W79-05269

ALGAE AND WATER POLLUTION,
C. M. Palmer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 128, Price codes: A07 in paper copy, A01 in microfiche. Report No EPA-600/9-77-036, December 1977. 124 p, 73 fig, 24 tab, 283 ref. 1BC611. 68-03-0232.

Descriptors: *Water quality control, *Algae, *Water pollution effects, *Eutrophication, *Manuals, *Water pollution control, *Identification keys, *Algal control, Beneficial use, Identification, Odor-producing algae, Taste-producing algae, Filter-clogging algae, Streams, Lakes, Reservoirs, Floral lists, Cyanophyta, Chlorophyta, Diatoms, Chrysophyta, Sewage lagoons, Stabilization ponds, Toxicity, Phytoplankton, Sessile algae, Bioindicators, Methodology, Estuaries, Bibliographies.

An updated enlargement of a 1959 manual gives greater emphasis to algae associated with water pollution. New chapters include algae in streams, algae and eutrophication, algae and estuarine pollution, algae as water quality indicators, and algae in sewage stabilization ponds. New material was added to original chapters which deal with the significance and ecology of algae, algal identification, algae in lakes and reservoirs, attached algae, clean-water algae, algae and freshwater pollution, taste and odor algae, filter and screen-clogging algae, other problems caused by algae (slime, coloration, toxicity, parasites, radioactivity), additional uses for algae (in industry, food for fish, waste treatment, marine pollution indicators, indicators of temperature, pH, and toxicity), algal enumeration procedures, and algal control. The revised identification key contains many additional species, and the most important are illustrated in color plates. Most chapters include a selected bibliography and list of typical algae for the situation under discussion, and an extensive bibliography is appended to the manual. The manual is intended for use by staff of water or wastewater treatment plants, to assist them in diagnosing and remedying problems caused by algae, such as odor, taste, and clogging of filters. Algal control methods are discussed for raw water supplies, recreational waters and fish ponds, treatment plants, and distribution systems. (Lynch-Wisconsin)
W79-05322

ENVIRONMENTAL CHANGES FROM LONG-TERM LAND APPLICATION OF MUNICIPAL EFFLUENTS,
Environmental Protection Agency, Washington, DC. Office of Air and Water Programs.
T. D. Hinesly, R. E. Thomas, and R. G. Stevens.
Technical Report No. 430/9-78-003, June 1978. 32 p, 6 tab, 12 ref.

Descriptors: *Municipal wastes, *Sewage disposal, *Land treatment, *Land application, *Bakersfield(CA), *Lubbock(TX), *Irrigation, *Ultimate disposal, Groundwater, Chemical analysis, Environmental effects, Nitrogen, Phosphorus, Nutrients, Fertilization, California, Texas, Sewage treatment, Sludge treatment, Pastures, Surface irrigation, Sprinkler irrigation, Water pollution sources, Crop production, Beneficial use, Soils, Nitrates.

Soil and plant composition has not been noticeably affected by more than 35 years of waste effluent disposal on land around Bakersfield, California and Lubbock, Texas (except for soil phosphorus concentrations), but long-term sewage disposal on farm land seems to have caused unacceptable nitrate levels in groundwater. However, the groundwater contamination could be easily corrected at both sites by storing the effluent during the winter months and applying it so that nitrogen inputs are in balance with nitrogen uptake by crop plants. With such management soils at both sites potentially can remove contaminants from wastewates for many more years. Chemical analyses were carried out March 1975 at Bakersfield and June 1976 at Lubbock. In both localities about 16 mg of effluent are applied throughout the year on row and forage croplands. In general, crop production has been increased by use of the sewage effluent for irrigation, compared with alternate water sources and commercial fertilizer used on neighboring farms. At Bakersfield sewage is aerated for six hours prior to solids removal in clarifiers, then surface irrigated. At Lubbock all land application is conducted by one local farmer, who recently installed center-pivot sprinklers. (Lynch-Wisconsin)
W79-05323

PIGMENT COMPOSITION, PHOTOSYNTHESIS AND FINE STRUCTURE OF A NON-BLUE-GREEN PROKARYOTIC ALGAL SYMBIONT (PROCHLORON SP.) IN A DIDEMNID ASCIDIAN FROM HAWAIIAN WATERS,
Scripps Institution of Oceanography, La Jolla, CA.
N. Withers, W. Vidaver, and R. A. Lewin.
Phycologia, Vol 17, No 2, p 167-171, 1978. 2 fig, 1 tab, 15 ref.

Descriptors: *Prochloron, *Prochlorophyta, *Endozoic organisms, *Diplosoma virens, *Pigments, *Photosynthesis, *Plant morphology, *Marine algae, Algae, Prokaryotic algae, Ascidians, Hawaii, Coconut Island(Hawaii), Thylakoids, Cytological studies, Chlorophyll, Phycobilins, Carotenoids, Xanthophylls, Cyanophyta, Chlorophyta, Didemnids, Classification, Symbiosis, Benthic fauna.

A unicellular bright-green marine alga found growing endozoically in the didemnid ascidian (sea squirt) Diplosoma virens off Coconut Island, Oahu, Hawaii, is assigned to the new algal division, Prochlorophyta, and provisionally to the genus Prochloron. The alga is similar to cyanophytes in cell wall structure, in having prokaryotic cells, and in lacking organelles, but its photosynthetic lamellae (thylakoids) resembles that of eukaryotic chlorophyte chloroplasts more than that of a typical cyanophyte. Thylakoids tend to occur in pairs or stacks as in chlorophytes, and contain no detectable amounts of bilin pigments such as characterize blue-green algae, but have both chlorophyll-a and -b. Both isolated algal cells and those in the didemnids were capable of vigorous photosynthetic oxygen production in light. Maximum oxygen production was generally reached within one minute of illumination onset in isolated cells, and within two minutes with intact ascidian colonies. The cells were spherical, about 6-11 micrometers in diameter, and aqueous extracts was 6.5/1; a carotene fraction and several xanthrophylls were also present. Betacarotene accounted for 71% of total carotenoids. Ultrastructural features of the alga are similar to those of the related epizoic alga Prochloron didemni from Mexican waters. (Lynch-Wisconsin)
W79-05324

THE SHORT DAY RESPONSE IN ACROSYMPHYTON PURPURIFERUM (J. AG.) SJOST. (RHODOPHYCEAE, CRYTONEMIALES),
Groningen Rijksuniversiteit (Netherlands). Dept. of Systemic Botany.
A. M. Cortel-Breeman, and A. ten Hoopen.
Phycologia, Vol 17, No 2, p 125-132, June 1978. 6 fig, 2 tab, 18 ref.

Descriptors: *Photoperiodism, *Acrosymphyton purpuriferum, *Rhodophyta, *Tetrasporangia, *Life history studies, *Light, Algae, Pigments, Light intensity, Cycles, Stolons, Sporulation, Growth stages, Plant growth, Seasonal, Spores, Thalli, Tetrasporophytes, Crytonemiales, Critical day length, Short-day response.

Response of the red alga Acrosymphyton purpuriferum to short day length in terms of tetrasporangia formation in the tetrasporophyte differed from any known short-day response in algae or higher plants, and was mediated by a process other than the phytochrome mechanism. In A. purpuriferum the crustose tetrasporophyte produced tetrasporangia in short-day conditions (eight hrs light, 16 hrs dark) but not in long-day conditions (16 hrs light, eight hrs dark). At 12C with a short day length the first tetrasporangia were formed in eight days, and after 20 days all plants had formed tetrasporangia. A tetrasporangium sporulated 4-5 days after formation. As few as six short-day cycles were sufficient to induce a distinct response, and 15 cycles induced a response in all plants. Plants in which short-day cycles have induced a response continued to produce tetrasporangia in long-day conditions, but only in thallus parts which have been exposed to short-day conditions. The short-day response was unaffected by light breaks of white light or narrow-band colored light. The number of fertile plants decreased gradually with increasing day length over a broad range of light-dark re-

gimes. Critical day length (at which 50% of the plants become fertile) was influenced by irradiance, with an increase in irradiance causing an increase in critical day length. (Lynch-Wisconsin)
W79-05325

STEADY-STATE ENERGETICS OF A PLANKTONIC HERBIVORE,
Dunstaffinage Marine Research Lab., Oban (Scotland).
M. R. Droop, and J. M. Scott.
Journal of the Marine Biological Association of the United Kingdom, Vol. 58, No. 3, p 749-772, August 1978. 13 fig, 11 tab, 20 ref.

Descriptors: *Brachionus plicatilis, *Equilibrium, *Energy transfer, *Growth rates, *Herbivores, *Respiration, *Zooplankton, *Efficiencies, Algae, Tracers, Cobalt, Nutrients, Limiting factors, Vitamins, Vitamin B12, Nitrogen, Carbon, Rotifers, Assimilation, Food habits, Chemostats, Testing procedures, Transfer, Cultures, Excretion, Metabolism, Biomass, Input-output analysis, Fish food organisms, Food chains.

Growth rate and respiration were compared in a steady-state laboratory population of the small planktonic marine rotifer, Brachionus plicatilis (a fish food), with the alga Brachiomonas submarina as its food organism and cobalt-57-labelled vitamin B12 as the limiting nutrient. Ingestion and assimilation were high and not obviously dependent on growth rate, whereas growth efficiency correlated closely with growth rate; carbon and nitrogen excretion rates were finite at zero growth rate, increased rapidly with increasing growth rate, and tended toward infinity as maximum growth rate was approached. State variables were recorded at a number of steady states between zero dilution rate and washout, including: algal input biomass, algal (and fecal) output biomass, and rotifer (and gut) output biomass, in terms of carbon, nitrogen, and vitamin B12; and input and output of dissolved vitamin B12. From these were calculated input, ingestion, assimilation, excretion, and growth rates, and the associated transfer efficiencies. B. plicatilis was grown bacteria-free in a chemostat. Nitrogen and carbon excretion rates were correlated, and 'slow-adapted' and 'fast-adapted' modes of growth were distinguished, each having distinctive growth and energy parameters. (Lynch-Wisconsin)
W79-05326

PATTERNS OF PHOTOASSIMILATORY PRODUCTS IN PACIFIC RHODOPHYCEAE,
Cologne Univ. (Germany, F.R.). Botanisches Inst.
B. P. Kremer.
Canadian Journal of Botany, Vol 56, No 14, July 15, 1978, p 1655-1659. 1 fig, 2 tab, 21 ref.

Descriptors: *Rhodophyta, *Photoassimilation, *Photosynthetic products, *Floridosides, *Digeneasides, *Classification, Pacific Ocean, Oceans, Algae, Carbon radioisotopes, Heterosides, Carbohydrates, Ceramiales, Carbon, Assimilation, Photosynthesis, Floral lists, Tracers, Biochemistry.

Typical patterns of carbon-14-labelled photoassimilatory products were compared for 54 species of Pacific Rhodophyceae, representing 43 genera and six orders. The most strongly accumulated carbon-14-labelled carbohydrates of low molecular weight were the heterosides floridoside (2-O-D-glycerol-alpha-D-galactopyranoside) and digeneaside (2-D-glycerate-alpha-D-mannopyranoside). Carbon-14-labelled digeneaside is found only in Ceramiales and floridoside only in species of other orders. Accumulative soluble and insoluble end products of photosynthetic carbon reduction (particularly the diverse carbohydrates) have proved very useful for chemotaxonomic characterization of major taxa. Rhodophyceae differ from most other photoautotrophic plants by the occurrence of certain heterosides, such as the floridosides and a further glyoside, digeneaside. Occurrence and distribution of the soluble low-molecular-weight carbohydrates may reflect distinct relationships within the Rhodophyceae. As a percentage of total C-14-labelled assimilates, floridoside ranged from 27.8% in Prionitis lanceolata to 67.3% in Scinaia johnstoniae, while digeneaside ranged from 7.4% in Pterosiphonia dendroidea to 32.3% in Rhodomela larix. (Lynch-Wisconsin)
W79-05328

COMPARISON OF ALGAE IN EUPLANKTON, TYCHOPLANKTON, AND PERIPHYTON OF A TUNDRA POND,
Toronto Univ. (Ontario). Dept. of Botany.
R. G. Sheath, and J. A. Helleburst.
Canadian Journal of Botany, Vol 56, No 12, June 15, 1978, p 1472-1483. 7 fig, 1 tab, 42 ref.

Descriptors: *Euplankton, *Periphyton, *Tychoplankton, *Algae, *Tundra, *Ponds, *Species composition, *Nora Pond(Northwest Territories, Canada), Plankton, Canada, Northwest Territories(Canada), Cold regions, Ice cover, Chlorophyta, Cyanophyta, Diatoms, Chrysophyta, Biomass, Primary productivity, Floral lists.

Species composition, biomass, and productivity were significantly different among three algal communities of Nora Pond, a tundra pond near Tuktoyaktuk, Northwest Territories, Canada, sampled during the ice-free period (June-September) of 1974. Euplankton (open water), tychoplankton (entangled among vegetation near shore), and periphyton (surface population of submerged objects or substrates) were sampled. Of 166 algal species identified, 125 were among the euplankton (36 unique to this group), 104 among tychoplankton (10 unique), and 109 in periphyton (15 unique). Chlorophyceae was represented by the greatest number of species, followed by Cyanophyceae, Bacillariophyceae, and Chrysophyceae. A large proportion of unique tychoplankton species were desmids (Chlorophyceae), whereas unique periphyton species were largely diatoms; species unique to the euplankton were fairly evenly distributed among the higher taxa. Each community exhibited two biomass increases, with slight timing differences. Major contributors to euplankton biomass were nannoplanktonic flagellates (Chrysophyceae), while periphyton was dominated by large, colonial, filamentous, or desmid Chlorophytes. Tychoplankton dominants were intermediate between those of the other two communities. During the July maximum euplankton primary productivity was slightly greater than that of tychoplankton, but in late August tychoplankton was five times more productive. (Lynch-Wisconsin)
W79-05329

THE CHEMICAL COMPOSITION OF AQUATIC MACROPHYTES. II. AMINO ACID COMPOSITION OF THE PROTEIN AND NONPROTEIN IN FRACTIONS,
Guelph Univ. (Ontario). Dept. of Nutrition.
A. J. Muztar, S. J. Slinger, and J. H. Burton.
Canadian Journal of Plant Science, Vol. 58, No. 3, July 1978, p 843-849. 3 tab, 14 ref.

Descriptors: *Biochemistry, *Macrophytes, *Proteins, *Amino acids, *Nonprotein nitrogen, Nitrogen, Nutrients, Ontario(Canada), Canada, Lakes, Beneficial use, Cladophora glomerata, CHara, Myriophyllum spicatum, Potamogeton, Vallisneria americana, Elodea canadensis, Lemna minor, Glutamic acid, Aspartic acid, Glycine, Leucine, Lysine, Arginine, Valine.

The amino acid profile, crude protein, and true protein (sum of all amino acids) levels of several species of aquatic macrophytes collected from lakes in Ontario, Canada 1974-75 were determined by acid hydrolysis followed by ion-exchange chromatography. Tryptophan was determined colorimetrically, and for some species total nitrogen was diffracted to true protein nitrogen and nonprotein nitrogen using different solvents. Differences up to 6% were found between levels of crude protein and true protein. Major contributors to proteins were the nonessential amino acids glutamic acid, aspartic acid, and glycine, and the essential amino acids leucine, lysine, arginine, and valine. Levels of essential amino acids compared favorably with the FAO reference pattern and lead protein concentrate. Determinations for nonprotein nitrogen (NPN) and free amino acids (FAA) remaining in solution following precipitation of protein using 80% ethanol, 5% TCA, or 10% TCA were made for Cladophora glomerata, Myriophyllum spicatum, Potamogeton spp., and Vallisneria americana. Less total NPN remained in solution following ethanol extraction than either 5% or 10% TCA. In addition to amino acids normally occurring in protein, ornithine, citrulline, asparagine, glutamine, and gamma-amino butyric acid were also present in the NPN fraction. FAA content ranged about 6.6-16.8% total NPN, depending on species and extraction method. Analysis indicated this fraction could be nutritionally utilized by monogastric animals. (Lynch-Wisconsin)
W79-05330

THE UPTAKE, TRANSLOCATION AND METABOLISM OF DICHLOBENIL IN SELECTED AQUATIC SPECIES,
University of Strathclyde, Glasglow (Scotland). Dept. of Biology.
J. Mottley, and R. C. Kirkwood.
Weed Research, Vol. 18, No. 4, August 1978, p 187-198. 4 fig, 6 tab, 30 ref.

Descriptors: *Dichlobenil, *Translocation, *Metabolism, *Absorption, *Rorippa nasturtium-aquaticum, *Berula erecta, *Phragmites communis, Herbicides, Watercress, Aquatic weed control, Path of pollutants, Tracers, Carbon radioisotopes, Evaporation, Leaves, Stems, Roots.

A study of the mode of action of the herbicide dichlobenil (2,6-dichlorobenzonitrile) using three species of aquatic weeds showed reedgrass (Phragmites communis) most susceptible, watercress (Rorippa nasturtium-aquaticum) moderately susceptible, and narrow-leaved water parsnip (Berula erecta) resistant. Susceptibility of P. communis coincided with relatively high accumulation of carbon-14-labelled dichlobenil or metabolites in the leaves, despite high loss of carbon-14 dichlobenil vapor. Resistance of B. erecta accompanied relatively low translocation of carbon-14 to the leaves and loss from the leaves, while moderate susceptibility of watercress was related to low accumulation in leaves and stems, reflecting very high rates of loss of carbon-14 dichlobenil vapor. The role of metabolism, if any, in selectivity of carbon-14 dichlobenil remains uncertain. Ten days after root treatment of the three species with five ppm C14-labelled dichlobenil in a vapor-trapping device, C14 absorbed and translocated by P. communis was 4-6 times greater than that for B. erecta and R. nasturtium-aquaticum, and 6-11 times more carbon-14 dichlobenil vapor was lost from the leaves of watercress than from the other two species. Distribution of radioactivity in roots, stems, and vapor of watercress was uniform, though movement of carbon-14 from the roots was restricted in B. erecta. In P. communis carbon-14 accumulated to the highest degree in stems (rhizomes) and leaves. (Lynch-Wisconsin)
W79-05331

CHARACTERIZATION OF THE NITRATE REDUCTASE ACTIVITY IN THE DIATOM SKELETONEMA COSTATUM,
Bilbao Univ. (Spain). Dept. of Biochemistry.
J. L. Serra, M. J. Llama, and E. Cadenas.
Plant Science Letters, Vol. 13, No. 1, September 1978, p 41-48. 5 fig, 27 ref.

Descriptors: *Diatoms, *Skeletonema costatum, *Nitrates, *Reductase, *Reduction(Chemical), *Enzymes, *Limiting factors, Nitrogen, Marine algae, Phytoplankton, Chrysophyta, Magnesium, Phosphates, Hydrogen ion concentration, Methodology, Testing procedures, Analytical techniques, Centric diatoms, Amino acids, Ammonium.

Nitrate reductase was easily extracted in cell-free extracts of the marine centric diatom Skeletonema costatum and showed magnesium and phosphate activation with an optimum pH of 7.9. The enzyme was easily extracted by rupturing the cells with a Teflon-pestle homogenizer, with 85% maximum extracted activity after homogenization for one min.; glass fiber filters facilitated extraction. Nitrite formation was linear up to 60 min, and enzymatic

activity was proportional to protein concentration in crude extracts over at least a four-fold range. K sub m was 0.24 mM for nitrate and 20 microM for NADH. NADPH was substitutable for NADH as an obligatory electron donor, but with much less efficiency. Neither ammonium nor amino acids affected in-vitro activity, though ammonium exerted a rapid in-vivo inactivation of the NADH-nitrate reductase and associated activities. The enzyme is more ammonium-repressible than nitrate-inducible. Nitrate reductase activity has been described for a large number of higher plants, green algae, fungi, cyanophyceae, and bacteria, but little work has been done with marine phytoplankton. Present results for nitrate reductase from S. costatum do not differ significantly from other studies. Nitrate reduction is a particularly vital function of marine algae since nitrogen appears to be their rate-limiting nutrient and growth-controlling factor. (Lynch-Wisconsin)
W79-05332

INTRACELLULAR OXYGEN AND RADIOSENSITIZATION OF THE BLUE-GREEN ALGAE,
Akademiya Nauk URSR, Kiev. Plant Physiology Inst.
A. P. Dmitriev, N. I. Gucsha, and D. M. Grodzinsky.
Plant Science Letters, Vol. 12, No. 3-4, August 1978, p 361-364. 2 fig, 12 ref.

Descriptors: *Cyanophyta, *Oxygen, *Radiosensitivity, *Photosynthesis, *Anacystis nidulans, *Carbon dioxide, *Light, Chlorophyta, Chlorella pyrenoidosa, Algae, Nitrogen, Irradiation, Gamma rays, Anaerobic conditions, Chlorophyll.

Oxygen generated intracellularly in photosynthesis by the blue-green alga Anacystis nidulans radiosensitized the alga to almost the same extent as oxygen from extracellular sources. A. nidulans irradiated with gamma rays in the presence of carbon dioxide and light in anoxic conditions showed increased radiation sensitivity with an oxygen-enhancement ratio of 2.0, but neither light alone nor CO2 alone affected sensitization. The level of inactivation of oxygen-evolving photosynthesis was 30% nitrogen at a dose of 100 krad of gamma irradiation. The photoautotrophic prokaryotic cyanophytes (cyanobacteria) exhibit relatively low mutagenic efficiency of some physical and chemical factors as well as high resistance to gamma rays, indicating high genetic stability. There appear to be effective systems of recovery from lethal and premutational lesions in DNA, and enzymatic photoreactivation and photorecovery after gamma irradiation that they possess a system analogous to the dark-repair type of bacteria. It is well-known that cell sensitivity to ionizing radiation is commonly increased two- to three-fold by oxygen presence. Irradiation effects on the chlorophyte Chlorella pyrenoidosa are also given. The photosynthetic system of A. nidulans was more sensitive than that of Chlorella, but the cyanophyte had a much higher survival rate than Chlorella, opposite to the radiation sensitivity of their photosynthetic systems. (Lynch-Wisconsin)
W79-05333

ON THE NUTRITION AND METABOLISM OF ZOOPLANKTON. XII. MEASUREMENTS BY RADIOIMMUNOASSAY OF THE LEVELS OF A STEROID IN CALANUS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
S. C. M. O'Hara, E. D. S. Corner, and C. C. Kilvington.
Journal of the Marine Biological Association of the United Kingdom, Vol. 58, No. 3, p 597-605, August 1978. 18 fig, 3 tab, 23 ref.

Descriptors: *Zooplankton, *Steroids, *Calanus helgolandicus, *Analytical techniques, *Radioimmunoassay, *Estradiol-17beta, *Costs, Copepods, Cholesterol, Calanus finmarchicus, Norway, England, Metabolism, Nutrients, Methodology, Testing procedures, Measurements, Traces, Radioactivity techniques, Estrogens, Hormones, Bioassay, Lipids, Reproduction, Growth stages, Physiology.

Radioimmunoassay was used for the first time with zooplankton to detect and quantify the steroid sex hormone estradiol-17beta (E2) in the copepods Calanus helgolandicus from Plymouth Sound, England, and C. finmarchicus from off the Norwegian Atlantic coast. E2 levels of 17.8-58.7 fg/animal were found in adult female C. helgolandicus collected in spring and summer, with maximum in early July. In adult males in spring and summer the level was 49.1 fg, and in stage V 43.8 fg. In females the steroid level was equivalent to .00000248% of cholesterol content and accounted for .000000141% of total lipid. In spring E2 concentration in stage V C. finmarchicus was .000000182-.000000203% of total lipid, and in stage V C. helgolandicus it was .00000006%. Chloresterol is known to have an important biological function in prawns and crabs, possibly as a precursor of such steroid hormones as the estrogen E2. Evidence of E2 in Calanus supports the view that these animals contain enzymes needed for synthesis of C18 steroids from cholesterol. A highly specific antibody, antiestradiol-6-carboxymethyloximine-BSA, was used in the tests. The radioimmunoassay technique consists of adding the antibody with a known quantity of isotope-labelled steroid to the sample, and estimating the quantity of labelled material bound by the antibody (which is inversely proportional to the unlabelled steroid) by radioactive counting. (Lynch-Wisconsin)
W79-05334

ALGAE OF SALTMARSHES ON THE SOUTH AND SOUTHWEST COASTS OF ENGLAND,
Katholieke Univ., Nijmegen (Netherlands). Lab. voor Aquatische Oecologie.
P. J. G. Polderman.
British Phycological Journal, Vol. 13, No. 3, p 235-240, September 1978. 16 ref.

Descriptors: *Salt marshes, *England, *Algae, *Estuaries, *Bristol Channel(England), *Coastal marshes, Species composition, Species richness, Cladophora globulina, Vaucheria, Spartina, Bostrychia scorpioides, Fucus, Wadden Sea(Netherlands), Norfolk(England), Flora lists, Cyanophyta, Chlorophyta, Porlock Weir(England), Keyhaven(England), Poole Harbor(England), Sand Bay(England), Berrow(England), Abundance, Dominant organisms, Netherlands, Islands.

Algal vegetation of three salt marshes along the Bristol Channel in southwestern England and two on the south coast of England was investigated 19-23 December 1975, and results were compared with data for Norfolk and the Wadden Sea area (Netherlands). Algal vegetation along the Bristol Channel was typically estuarine, as indicated by the abundance of Vaucheria compacts, and that of the south coast marshes was rich in species and communities. Cladophora globulina was newly reported for British marine flora (found in Poole Harbor marsh, Dorset). The other south coast marsh was Keyhaven (Hampshire), and the Bristol Channel marshes were Sand Bay (Avon), Berrow (Somerset), and Porlock Weir (Somerset). Twenty species of Cyanophyceae were identified, 14 Chlorophyceae, seven Zanthophyceae (Vaucheria spp.), six Phaeophyta, four Rhodophyta, one Haptophyceae, and one Chrysophyceae. The Porlock Weir salt marsh, with 21 species identified, was richer than the other two Bristol Channel marshes, but compared with salt marshes on the islands of the Dutch Wadden Sea which average 35 algal species, the Bristol Channel marshes are relatively poor in species. Allowing for the incompleteness of this study, the Bristol Channel marshes may average 25 species. Algal vegetation in the two southern marshes is very similar to that at Norfolk, and Poole Harbor with 36 species and Keyhaven with 38 compare favorably with the Wadden islands. (Lynch-Wisconsin)
W79-05335

THE PHYTOPLANKTON CHARACTERISTICS OF THE BARRIER ISLAND LAGOONS OF THE GULF OF CALIFORNIA,
Maine Univ. at Orono. Center for Marine Studies.
M. Gilmartin, and N. Revelante.
Estuarine and Coastal Marine Science, Vol. 7, No. 1, p 29-47, July 1978. 5 fig, 7 tab, 34 ref. NSF GA3127-1X and GF 31947X.

Descriptors: *Gulf of California(Mexico), *Phytoplankton, *Lagoons, *Eutrophication, *Baja California(Mexico), *Primary productivity, Gulfs, Seas, Pacific Ocean, Oceans, Mexico, Algae, Barrier islands, Tidal effects, Chlorophyll, Salinity, Flushing rate, Species composition, Upwelling, Species diversity, Floral lists, Nutrients, Standing crops, Thalassionema nitzschioides, Skeletonema costatum, Assimilation number, Water temperature, Nearshore zone, Coasts, Sampling.

Comparative study of 15 lagoons on the Gulf of California and of the open gulf conducted July-August 1972 (during lowest upwelling and before the rainy season) showed that the lagoons markedly influence phytoplankton productivity in eastern inshore waters of the central gulf. A dramatic inshore increase was found in cell densities, chlorophyll-a standing crop, and primary production rate. Increased phytoplankton activity in the gulf has usually been attributed to nutrient input from upwelling, and to a lesser degree to tidal mixing in island channels. Positive correlation was established among lagoon flushing rates, nutrients, chlorophyll-a biomass (to over 19.5 mg/cu m), and primary production (to over 185 mg C/cu m/hr), apparently related to lagoon trapping of nutrients and/or eutrophication. Positive correlation was also found between lagoon assimilation number (to over 12.5) and temperature (to over 31C). Particularly noteworthy were the high assimilation values in inshore waters–well in excess of five, and indicative of eutrophic conditions. Such values, correlated with tidal flushing indices and the characteristics of the lagoon waters clearly indicate the positive influence of the lagoons on primary production of the eastern gulf. Thalassionema nitzchiodes and Skeletonema costatum were the most important species in the eastern lagoons. Sixty-one stations were sampled between Bahia de los Angeles and Estero de Urias. (Lynch-Wisconsin)
W79-05337

NITROGEN FIXATION (ACETYLENE REDUCTION) BY EPIPHYTES OF FRESHWATER MACROPHYTES,
Cornell Univ. Medical Coll., New York. Dept. of Microbiology.
L. R. Finke, and H. W. Seeley, Jr.
Applied and Environmental Microbiology, Vol. 36, No. 1, p 129-138, July 1978. 6 fig, 2 tab, 44 ref.

Descriptors: *Nitrogen fixation, *Epiphytes, *Acetylene reduction, *Myriophyllum spicatum, *Nitrogen fixing bacteria, *Cyanophyta, *Eutrophication, *Photosynthesis, Macrophytes, Biorhythms, Ethylene, Seasonal, Microorganisms, Bacteria, Cyanobacteria, Gloetrichia, Rhodopseudomonas, Dryden Lake(NY), Cayuta Lake(NY), New York, Nitrogen, Algae, Lakes, Ponds, Bioassay, Eurasian water milfoil.

In eutrophic water with extensive macrophyte growth, epiphytic blue-green algae and photosynthetic bacteria may contribute significantly to nitrogen fixation, based on a 1973 survey of epiphytes in lakes and ponds near Ithaca, New York and on a detailed study 1974-75 in one experimental pond. Acetylene reduction was used to estimate nitrogen fixation by epiphytes in Dryden and Cayuta Lakes and in several experimental ponds, and to follow diel and seasonal cycles of nitrogen fixation by epiphytes of Myriophyllum spicatum (Eurasian water milfoil) at the experimental site during the longer study. All plant samples collected during the survey showed some acetylene reduction. Experiments showed heterocystous blue-green algae (cyanobacteria), especially Gloeotrichia, to be primarily responsible for nitrogen fixation, but photosynthetic bacteria of the genus Rhodopseudomonas isolated from M. spicatum also showed high rates of acetylene reduction. Acetylene reducing activity was highest noon-6 pm, but also continued through the night. Activity began in May, abruptly increasing to 0.45-0.95 nmols ethylene/mg plant dry wt/hr. During summer mean rates remained between 0.15-0.60

nmol, gradually declined in fall, and ceased in January and February. Epiphytes added 7.5-12.5 micrograms N/mg plant/yr to the pond, a significant amount relative to the total amount of nitrogen incorporated into M. spicatum. (Lynch-Wisconsin)
W79-05338

PHYSICAL QUALITY AND SEDIMENT TRANSPORT IN DRAINAGE WATER FROM A MANURED AND FERTILIZED CROPPING OPERATION,
Department of Agriculture, Ottawa (Ontario). Animal Research Inst.
For primary bibliographic entry see Field 5G.
W79-05339

MERCURY IN SEDIMENTS OF LAKE PAIJANNE, FINLAND,
Jyvaskyla Univ. (Finland). Dept. of Biology.
J. Sarkka, M. L. Hattula, J. Janatuinen, and J. Paasivirta.
Bulletin of Environmental Contamination and Toxicology, Vol. 20, No. 3, September 1978, p 332-339. 2 fig, 2 tab, 23 ref.

Descriptors: *Mercury, *Sediments, *Water pollution effects, *Lake Paijanne(Finland), *Bioaccumulation, *Path of pollutants, *Pulp and paper industry, Finland, Lakes, Food webs, Pollutants, Industrial wastes, Food chains, Slimicides, Caustic soda, Heavy metals, Sedimentation.

Of an estimated 82 kg mercury discharged per year during 1953-66 into Lake Paijanne, Finland from pulp and paper wastes, a great part did not settle into sediments, but instead found its way into various levels of the food chain. Fairly high mercury content was found in plankton, zoobenthos, aquatic plants, fish, and birds during sampling in the summers of 1972-74. Total mercury discharged averaged 750 micrograms Hg/sq m/yr over the lake's 1090 sq km. Average sedimentation of about 0.6 mm/yr, or 600 g/sq m/yr as wet wt (about 192 g/sq m/yr dry wt) would mean sediment layer content of about 3900 micrograms Hg/kg, but the mean for all samples was only 360 micrograms Hg/kg. For the upper layer in profundal depths the mean was 340 micrograms/kg, and for the lower layer it was 610 micrograms/kg. Although the highest mercury levels were found in lower layers at stations 1 and 2 where most of the mercury was discharged, the maximum level was only 1090 micrograms/kg. However, high levels relative to probable natural levels found in profundal depths of stations 3 and 4 show that the mercury was transported into sediments located relatively distant from the pollutant's origin. Mercury was used as a slimicide by the pulp and paper industry until 1968, and also appeared as an impurity in caustic soda. About 20% of the total 4.1 tons/yr discharged into Finnish waters 1953-66 went into Lake Paijanne. (Lynch-Wisconsin)
W79-05340

EFFECT OF ALGAL DIET AND TEMPERATURE ON THE BIOCHEMICAL COMPOSITION OF THE ROTIFER, BRACHIONUS PLICATILIS,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England).
A. P. Scott, and S. M. Baynes.
Aquaculture, Vol. 14, No. 3, July 1978, p 247-260. 2 fig, 6 tab. 17 ref.

Descriptors: *Brachionus plicatilis, *Rotifers, *Water temperature, *Biochemistry, *Fish food organisms, *Food habits, *Limiting factors, *Fish farming, *Aquiculture, Algae, Growth rates, Weight, Carbohydrates, Proteins, Data collections, Dunaliella tertiolecta, Pavlova lutheri, Phaeodactylum tricornutum, Isochrysis galbana, Turbot, Scopthalmus maximus, Anchovy, Engraulis mordax, Siganus lineatus, Larvae.

Type of alga used as food for the retifer Brachionus plicatilis had little effect on growth rate, weight, or level of total protein, carbohydrate, or lipid; however, weight and biochemical composition were strongly affected by differences in water temperature and amount of food available. These rotifers are used extensively as live food for rearing small larval fishes such as turbot (Scopthalmus maximus), anchovy (Engraulis mordax), and Siganus lineatus. In tests they were fed four unicellular algal species, Dunaliella tertiolecta, Pavlova lutheri, Phaeodactylum tricornutum, and Isochrysis galbana. In contrast with Artemia salina, whose growth rate was greatly affected by type of algae used as food, the only significant effect of algal species was that rotifers fed on D. tertiolecta were consistently richer in carbohydrate. On the other hand, at low temperatures (18C) rotifers consumed their food fairly slowly and maintained relatively high lipids and carbohydrates for a long period, while at high temperatures (28C) food was consumed quickly and composition of the rotifers declined rapidly when food was gone. The significant fall in weight and biochemical composition (though not in size) with starvation indicates the importance of keeping the rotifers well-fed in larval fish rearing tanks. (Lynch-Wisconsin)
W79-05341

SUBSTRATE SELECTION BY LARVAE OF THE SESSILE ROTIFER PTYGURA BEAUCHAMPI,
Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences.
R. L. Wallace.
Ecology, Vol. 59, No. 2 1978, p 221-227, 3 fig, 3 tab, 27 ref. NSF BMS 75-03107, DEB 75-03175.

Descriptors: *Larvae, *Symbiosis, *Ptygura beauchampi, *Utricularia vulgaris, *Rotifers, *Carnivorous plants, *Epiphytes, *Predation, Sessile organisms, Utricularia, Habitats, Substrates, Kairomones, Trichomes, Allomones, Commensal, Invertebrates, Benthic fauna, Benthic flora.

Larvae of the sessile rotifer Ptygura beauchampi begin substrate selection activities (presettling movement, attachment, and metamorphosis) upon chemotactual sensing of a stimulus released by the terminal heads of glandular trichomes covering Utricularia vulgaris, a carnivorous plant which is the preferred substrate of the rotifer. P. beauchampi attaches itself to the trapdoor region of the large prey-capturing Organis of U. vulgaris. The stimulus, a stable, chemical substance, arises from the head cell of trichomes when they reach a certain developmental stage, characterized by splitting and dislodgment of the cuticular sheath and subsequent formation of bacterial-mucilage complex (which is not the source of the stimulus). The chemical substance, an alletochemic agent which is probably present inside young trichomes but not released, may be the utricularian prey-lure proposed by Cohn in 1875. Four other co-occurring, congeneric species (U. gibba, U. inflata minor, U. intermedia, and U. purpurea) and two smaller and morphologically distinct trap types of U. vulgaris were not colonized. All of the Utricularia traps except U. purpurea have glandular trichomes which are nearly identical. The symbiotic relationship is commensal because rotifers colonize but do not feed on the plant or its prey (deriving mainly a refuge from predation), and because the plant is unaffected by the colonization. (Lynch-Wisconsin)
W79-05345

POPULATION DYNAMICS AND PRODUCTION OF A PLANKTONIC MARINE COPEPOD, ACARTIA CLAUSII, IN A SMALL TEMPERATE LAGOON ON SAN JUAN ISLAND, WASHINGTON,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
M. R. Landry.
Internationale Revue der Gesamten Hydrobiologie, Vol. 63, No. 1, p 77-119, 1978. 28 fig, 47 ref. NSF DES 74-22640.

Descriptors: *Acartia clausii, *Copepods, *Zooplankton, *Lagoons, *Population dynamics, *Productivity, Washington, San Juan Island(WA), Islands, On-site tests, Laboratory tests, Time series analysis, Seasonal, Mortality, Fecundity, Cycles, Abundance, Water temperature, Predation, Fish, Jakle's Lagoon(WA), Saline water, Tidal effects, Life history studies, Growth stages, Gasterosteus aculcatus, Fish food organisms.

Seasonal abundance of the planktonic marine copepod Acartia clausii in small, temperate Jakle's Lagoon on the southern end of San Juan Island, Washington is controlled by an annually consistent pattern of copepod and adult mortality believed due to predation by the lagoon's dominant fish, the three-spined stickleback (Gasterosteus aculcatus). Population abundance is further regulated by cannibalism and periodic tidal stimulation of egg hatching accumulated in the sediment. Population size increases rapidly in March and April, rises to a maximum in late June (about three million/sq m), and declines through July and August. Production of the lagoon population was 229 kg C over a two-year study period (1973-74), with 84-88% occurring April-July. Below a depth of three meters mean daily production during peak months was 70 mg C/sq m in 1973 and 55 mg in 1974. Seasonal changes were analyzed through integrated laboratory and in-situ experiments with time-series sampling of the field population; development, growth, fecundity, and mortality were investigated. Cycles of abundance, similar in the two study years, were not affected by differences in cycles of tidal inflow, temperature, or food availability; but the latter two appreciably affected rates of growth, development, and fecundity. The lagoon is separated from Griffin Bay by a bar of gravel and driftwood and is bounded on three sides by forest. Runoff is the only source of freshwater inflow. (Lynch-Wisconsin)
W79-05346

PRODUCTIVITY STUDIES ON BALTIC MACROALGAE,
Stockhold Univ. (Sweden). Inst. of Botany.
I. Wallentinus.
Botanica Marina, Vol. 21, No. 6, p 365-380, August 1978. 8 fig, 3 tab, 26 ref.

Descriptors: *Baltic Sea, *Primary productivity, *Algae, *Chlorophyta, *Phaeophyta, *Rhodophyta, Seas, Carbon radioisotopes, Seasonal, Macrophytes, Sweden, Archipelagoes, Chorophyll, Photosynthesis, Photosynthetic index, Monostroma grevillei, Acrosiphonia centralis, Cladophora glomerata, Pilayella littoralis, Scytosiphon lometaria, Dictyosiphon lomentaria, Dictyosiphon foeniculaceus, Furcellaria fastigiata, Phyllophora truncata, Ceramium tenuicorne, Rhodomela confervoides.

Intraspecific primary productivity varied as much as tenfold for the macroalgae Cladophora glomerata (1.5-11.4 mg C/g dry wt/hr), Ceramium tenuicorne (0.8-8.5 mg C), and Pilayella littoralis (0.6-6.1 mg C) in studies performed in-situ in the northern Baltic Sea and in a laboratory incubator using the carbon-14 method. Results suggest that productivity values should be given together with such physiological characteristics as chlorophyll or nitrogen content, to facilitate evaluation of the influence of environmental variables. Intraspecific variation can greatly exceed interspecific variation for different species grown under similar conditions. Expressing results as mg C assimilated per mg chlorophyll-a (photosynthetic index) often reduces differences considerably, both within and among species. The 10 algal species investigated were studied seasonally in the Baltic Sea archipelago south of Stockholm, Sweden. Species were the chlorophytes Monostroma grevillei, Acrosiphonia centralis, and Cladophora glomerata; the phaeophytes pilayella littoralis, Scytosiphon lomentaria, and Dictyosiphon foeniculaceus; and the rhodophytes Furcellaria fastigiata, Phyllophora truncata, Ceramium tenuicorne, and Rhodomela confervoides. Influence of sample size and length is discussed. Twenty-four-hour experiments were used to calculate turnover times for four species. (Lynch-Wisconsin)
W79-05347

REGENERATION OF THALLUS FRAGMENTS OF RHODOCHORTON PURPUREUM (RHODOPHYCEAE, NEMALIONALES),
Purdue Univ., Lafayette, IN. Dept. of Botany and Plant Pathology.
N. L. Pearlmutter, and R. L. Vadas.
Phycologia, Vol. 17, No. 2, p 186-190, June 1978. 12 fig, 17 ref.

Descriptors: *Rhodochorton purpureum, *Thalli, *Reproduction, *Regeneration, *Fragmentation, *Plant growth, *Vegetative reproduction, Algae, Rhodophyta, Nemalionales, Cultures, Rhizoids, Apical cells, Filamentous algae, Salinity, Growth stages, Maine, Intertidal areas, Spores, Habitats, Asexual reproduction.

Cut filament fragments of the rhodophyte alga Rhodochorton purpureum regenerated readily in laboratory culture, suggesting that dispersion of this species in intertidal habitats may result from thallus fragmentation caused by wave action. Fragmentation, or vegetative propagation, may thus explain the presence of algae in environments where such factors as temperature or light are unfavorable for reproduction by spore germination. R. purpureum was collected from beneath Ascophyllum nodosum at Thunder Hole on Mt. Desert Island, Maine, in November 1972, cut with a razor blade, and grown in Provasoli medium of varying salinity. Most fragments produced an adhesive rhizoid from one cut end of the filament before a shoot or another hizoid developed from the opposite cut end. Patterns of regeneration by unbranched fragments 1-10 cells long without apical cells of 7%, 17%, and 31% salinity were similar, but filaments grew most rapidly in 17%. Regeneration was detectable 24-48 hrs after thalli were fragmented and placed in fresh medium. Within 20 days 89% of the fragments had regenerated new cells from one or both cut ends. Apical fragments were studied in medium of 17% salinity, and intact apical cells on fragments did not appear to inhibit regeneration or branch initiation. Any cell of R. purpureum can potentially regenerate a new thallus, an event apparently triggered by removal of an abutting cell. (Lynch-Wisconsin)
W79-05349

PHYTOPLANKTON PRODUCTION AT TWO STATINS IN LINDA-SPOLLENE, A NORWEGIAN LAND-LOCKED FJORD, AND LIMITING NUTRIENTS STUDIED BY TWO KINDS OF BIO-ASSAYS,
Bergen Univ. (Norway). Inst. of Marine Biology.
C. Lannergren.
Internationale Revue der Gesamten Hydrobiologie, Vol. 63, No. 1, p 57-76, 1978. 11 fig, 43 ref.

Descriptors: *Analytical techniques, *Bioassay, *Phytoplankton, *Primary productivity, *Lindaspollene(Norway), *Limiting factors, *Fjords, *Testing procedures, Methodology, Onsite tests, Norway, Chlorophyll, Species composition, Phosphates, Nitrates, Silicates, Salinity, Algae, Nutrients, Sewage disposal, Water pollution effects, Carbon, Nitrogen, Nannoplankton, Laboratory tests.

Field and laboratory bioassays were made of primary productivity, chlorophyll-a concentrations, and quantity and composition of phytoplankton at two stations in Lindaspollene, a Norwegian landlocked fjord. Station 1 in Spjeldnesosen was more influenced by freshwater runoff than station 2 in Straumsosen, and in 1972 sewage discharge to Spjeldnesosen was about doubled by addition of a new outfall. Station 1 was characterized by frequent low salinities and high nutrient content, and station 2 by higher and more stable salinities and somewhat lower nutrient levels. In the field bioassay combinations of phosphate, nitrate, and silicate were added to natural water in-situ, and in the laboratory bioassay natural water was incubated. Although the bioassays showed nitrogen to be the main limiting nutrient, the biological parameters showed no consistent differences between the two stations, tentatively explained by the growth of nannoplankton which depended on nutrients other than those analyzed. There was no correlation between nitrate content and in-situ carbon assimilation rates in the field bioassay, and there was no significant difference in phytoplankton biomass or production rates between the two stations, despite the fact that average nitrate content was higher at station 1 and higher yields were obtained with water from station 1 in the laboratory bioassay. (Lynch-Wisconsin)
W79-05350

PHYTOPLANKTON PRIMARY PRODUCTIVITY AND POPULATION EFFICIENCY STUDIES IN A PRAIRIE-PARKLAND LAKE NEAR EDMONTON, ALBERTA, CANADA,
Alberta Univ., Edmonton. Dept. of Botany.
M. Hickman, and C. G. Jenkerson.
Internationale Revue der Gesamten Hydrobiologie, Vol. 63, No. 1, p 1-24, 1978. 14 fig, 65 ref.

Descriptors: *Phytoplankton, *Primary productivity, *Standing crops, *Hastings Lake(Alberta, Canada), *Light intensity, *Eutrophication, *Photosynthesis, Canada, Alberta(Canada), Lakes, Chlorophyll, Carbon, Efficiencies, Depth, Stratification, Algae, Microcystis aeruginosa, Gomphosphaeria lacustris, Cyanophyta, Chlorophyta, Flagellates, Chlamydomonas globosa, Cryptomonas ovata, Rhodomonas minuta.

Phytoplankton standing crop and primary productivity were both high in Hastings Lake, a relatively small, edaphically eutrophic, prairie-parkland lake east of Edmonton, Alberta, Canada, and productivity declined with light intensity at lower depth. Mean standing crop was 29.24 mg chlorophyll-a/cu m, or 73.09 mg/sq m, and mean primary productivity was 78.71 mg C/hr/cu m, or 196.77/sq m. From summer to early winter phytoplankton was dominated by cyanophytes, Microcystis aeruginosa in particular, and also Gomphosphaeria lacustris, Anabaena circinalis, and Oscillatoria sp. Under the winter ice cover phytoplankton was dominated by the flagellated algae Chlamydomonas globosa, Cryptomonas ovata, Rhodomonas minuta, and to a lesser extent Gonium sociale. There was a winter minimum, and spring and late summer maxima. Primary productivity was low during winter and undetectable below three meters. The relationships between primary productivity and incident solar radiation and between maximum productivity and water temperature were significant, but that between productivity and standing crop was not. Determination of primary productivity efficiency provided a negative regression with light intensity; a logarithmic curve fit the data best. Seasonal changes in photosynthetic indices were closely related to incident solar radiation. (Lynch-Wisconsin)
W79-05351

EFFECT OF SULFUR DIOXIDE ON ALGAE,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy.
R. S. Wodzinski, and M. Alexander.
Journal of Environmental Quality, Vol. 7, No. 3, p 358-360, 1978. 2 tab, 10 ref. U.S. EPA R-803691.

Descriptors: *Anabaena flos-aquae, *Chlamydomonas reinhardtii, *Sulfur dioxide, *Toxicity, *Photosynthesis, *Air pollution effects, *Water pollution effects, Soil types, Lima loam soil, Algae, Sulfur, Bisulfite, Poisons, Pollutants, Chlorophyta, Cyanophyta, Acidity, Hydrogen ion concentration, Soil contamination, Buffers, Phosphates, Soils.

Laboratory tests showed that photosynthesis of both the blue-green alga Anabaena flos-aquae and the green alga Chlamydomonas reinhardtii are almost totally inhibited by 1.0 ppm airborne sulfur dioxide (SO2) in 24 hrs. Previous work showed that blue-green algae were 10 times more sensitive to bisulfite than green algae, suggesting that if true also for sulfur dioxide significant inhibition of cyanophtes may occur at SO2 concentrations much lower than 1.0 ppm. Sulfur dioxide toxicity increases with decreasing pH, indicating that SO2-polluted air may be particularly harmful in ecosystems with low pH or those in which pH is lowered by acid precipitation from SO2 or other air pollutants. In these tests, A. flos-aquae and C. reinhardtii photosynthesis was almost completely inhibited in a thin layer of Bristol's medium at an initial pH of 6.0 exposed to air with 1.0 ppm SO2. The pH of the medium decreased to 5.2 or below during the test, but addition of soil or phosphate buffer to prevent the decrease in pH resulted in no inhibition of photosynthesis. Addition of acidic soil to a medium of pH 4.9 offered no protection from adverse SO2 effects. Photosynthetic inhibition may not be caused solely by increased hydrogen ion concentration, since control samples at pH below 5.0 continued to demonstrate photosynthetic activity. In Lima loam soil of pH 7.1 photosynthesis was unaffected by exposure to 0.5 ppm SO2 in air. (Lynch-Wisconsin)
W79-05352

SOME ASPECTS OF SEDIMENT DISTRIBUTION AND MACROPHYTE CYCLING OF HEAVY METALS,
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.
A. W. McIntosh, B. K. Shephard, R. A. Mayes, G. J. Atchinson, and D. W. Nelson.
Journal of Environmental Quality, Vol. 7, No. 3, p 301-305, July-September 1978. 4 fig, 45 tab, 15 ref. NSF-RANN GI35106.

Descriptors: *Sediments, *Heavy metals, *Macrophytes, *Path of pollutants, *Cadmium, *Zinc, *Palestince Lake(IN), *Aquatic weed control, Indiana, Distribution, Lakes, Eutrophication, Herbicides, Chemcontrol, Water pollution effects, Aerial photography, Potamogeton crispus, Industrial wastes, Electroplating, Poisons, Pollutants, Shallow water, Effluents.

Cadmium and zinc distribution in sediments of shallow, eutrophic, 93-ha Palestine Lake (Kosciusko County, Indiana) contaminated by wastes from an electroplating company, was investigated 1975-76, as was potential release of accumulated cadmium from a massive infestation of the macrophyte Potamogeton crispus subsequently treated with herbicides in May 1976. Cadmium levels in the upper five cm of sediments ranged from 2.54 ppm in the unpolluted northeastern basin to 805 ppm near the entrance of waste effluent-bearing Williamson Ditch to the lake's western basin. Corresponding zinc levels were 115 ppm in unpolluted sediments and 6120 ppm near the ditch entrance. In polluted areas metal contamination reached to a depth of 30 cm. Contamination levels in the west basin were much higher than those reported for most other systems, including Lake Erie. Dominant forms were the carbonate for cadmium, and carbonate and organic for zinc. Analysis of P. crispus indicated cadmium levels as high as 89.6 ppm, with a maximum burden of 1.5 kg Cd in the entire population. Release of the total amount could raise water pollution concentrations by a maximum of 1 microgram/liter. Standing crop of the dense populations of P. crispus, which completely filled much of the lake by mid April 1976, was estimated by low-level oblique color infrared aerial photographs. Alkalinity in lake water ranged 84-318 ppm in the form of CaCO3, and hardness was 190-360 ppm as CaCO3. (Lynch-Wisconsin)
W79-05353

COMMUNITY PRODUCTION AND RESPIRATION BY CILIATED PROTOZOA IN THE BENTHOS OF A SMALL EUTROPHIC LOCH,
Stirling Univ. (Scotland). Dept. of Biology.
B. J. Finlay.
Freshwater Biology, Vol. 8, No. 4, p 327-341, 1978. 11 fig, 5 tab, 47 ref.

Descriptors: *Biological communities, *Airthrey Loch(Scotland), *Eutrophication, *Protozoa, *Productivity, *Respiration, *Benthic fauna, Lochs, Lakes, Ciliated protozoa, Depth, Biomass, Typha latifolia, Loxocephalus plagius, Scotland, Energy.

Annual production of benthic ciliate protozoa in 1975-76 at three sites in 10-ha, shallow, highly eutrophic Airthrey Loch, Scotland decreased with increasing depth. Production was estimated at 345 J/sq cm/yr at site A in shallow water at the edge

of the small loch, 149 J at site B (0.8-1.8 m depth) in the Typha latifolia beds of the main loch. Annual respiratory energy losses also decreased with depth--16, 11, and 4 J/sq cm/yr at the three sites. Corresponding annual net production efficiencies for each period between sampling dates as 100 (daily production/daily assimilation)gave a range of 63-98. There are few published estimates of protozoan production, and no detailed studies of total ciliate faunal production, but it appears that figures for ciliates given here are at the upper end of the range for zoobenthic production. The high ciliate production values are especially notable in light of the very low respiratory energy losses. Summer biomass peaks were due to: (1) higher populations, and (2) increased proportion of ciliates in the larger size class. Much of the variation at sites A and B was caused by the sudden appearance of large numbers of Loxocephalus plagius. (Lynch-Wisconsin)
W79-05354

STABILITY AND COMPOSITION OF TERRESTRIALLY DERIVED DISSOLVED ORGANIC NITROGEN IN CONTINENTAL SHELF SURFACE WATERS,
Skidaway Inst. of Oceanography, Savannah, GA.
W. S. Gardner, and J. A. Stephens.
Marine Chemistry, Vol 6, No 4, p 335-342, 1978. 2 fig, 2 tab, 21 ref. NSF OCE72-06423.

Descriptors: *Continental shelf, *Dissolved organic nitrogen, *Dissolved organic carbon, *Nutrients, *Atlantic Ocean, *Stability, *Sea water, Georgia, Wassaw Sound(GA), South Atlantic Bight, Oceans, Carbon, Nitrogen, Coasts, Rivers, Salinity, Amino acids.

A linear decrease in dissolved organic carbon (DOC) and nitrogen (DON) with increasing salinity in surface water samples collected April 1977 on a transect 0-100 km off the Georgia Coast from Wassaw Sound suggests that organic nitrogen compounds contributed to coastal waters by rivers are stable during the 2-3 month period of their transfer over the continental shelf. While the carbon-nitrogen ratio decreased with distance from shore, total DON, total amino nitrogen, and primary amino nitrogen showed similar relative decreases, suggesting that nitrogen is associated with refractory organic compounds. Measured amino nitrogen accounted for about 20% of total DON, leaving about 80% of the organic nitrogen undefined. Substantial quantities of organic nitrogen compounds are added to coastal waters by rivers; about 5% of shelf water volume in the South Atlantic Bight is contributed annually by rivers. Salinities of the 20 samples collected from the transect ranged from 25% near shore to 35% 100 km offshore. The largest gradient occurred in the first 30 km. Linear correlation of DOC with salinity was highly significant ($r=0.98$, $p < 0.001$), and was also significant for DON ($r=0.89$, $p < 0.001$), though the relative seaward decrease was less for DON than for DOC. The C/N ratio was 15 at the nearshore end, compared with 11 for the seaward portion. The data suggest that most biological and chemical changes affecting river-derived DOC and DON have occurred by the time river water reaches the shore line. (Lynch-Wisconsin)
W79-05355

SOME ECOLOGICAL OBSERVATIONS ON A PERMANENT POND IN SOUTHERN ENGLAND: PRIMARY PRODUCTION AND PLANKTONIC SEASONAL SUCCESSION,
Oxford Univ. (England). Dept. of Zoology; and Oxford Univ. (England). Animal Ecology Research Group.
A. R. Russeo.
Hydrobiologia, Vol. 60, No. 1, p 33-48, 1978. 21 fig, 42 ref.

Descriptors: *Succession, *Ecology, *Ponds, *Primary productivity, *Phytoplankton, *Zooplankton, *Radley Pond(United Kingdom), *Seasonal, Alkalinity, United Kingdom, Permanent ponds, Cryptomonas, Diatoms, Chrysophyta, Algae, Macrophytes, Ceratophyllum demersum, Biomass, Volvox uareus, Copepods, Cladocera.

A study of Radley Pond, a 0.9-ha natural, permanent, alkaline pond near Oxford in Southern England September 1976-August 1977 showed that phytoplankton productivity was highest during spring and fall, and gross primary productivity was normal for shallow lakes and artificial ponds. Hourly rates of phytoplankton photosynthesis ranged from almost zero in winter to 475 mg C/cu m/hr in fall. Daily gross primary productivity per unit area varied 0.1-2.5 g C/sq m/day, and annual gross primary productivity of phytoplankton was estimated at .157 kg C/sq m/yr. Net primary productivity of open-water phytoplankton was about half that of pond macrophytes, dominated by Ceratophyllum demersum, which densely covered over 55% of the pond in summer. Peak biomass was 235 g (ash free)/sq m in July, and net annual primary productivity was 2.89 metric tons (ash free)/ha/yr. Net phytoplankton energy production was 3.29 million J/sq m/yr, compared with 6.25 million for macrophytes. Net production efficiencies ranged from .11% for phytoplankton to .21% for macrophytes. In fall during abnormally heavy rains, phytoplankton growth was intense, especially for the colonial alga Volvox aureus. Diatoms were abundant most of the year, with peaks during the fall and spring blooms. Zooplankton consisted of single-species associations with cladocerans and copepods dominant throughout the year; distinct generic seasonal successions were observed. (Lynch-Wisconsin)
W79-05356

DISSOLVED GLUCOSE IN A BAYOU ESTUARY, POSSIBLE SOURCES AND UTILIZATION BY BACTERIA,
University of West Florida, Pensacola. Faculty of Biology.
G. A. Moshiri, W. G. Crumpton, and N. G. Aumen.
Hydrobiologia, Vol. 62, No. 1, p. 71-74, 1979. 3 fig, 11 ref. OWRT B-024-FLA(7), 14-31-0001-5065.

Descriptors: *Glucose, *Estuaries, Primary productivity, Bacteria.

Surface and bottom samples were collected twice a month over a period of one year from three stations in Bayou Texar, Pensacola, Florida. Samples were analyzed for primary productivity, inorganic carbon, bacterioplankton heterotrophic productivity, dissolved glucose, and bacterial numbers. Dissolved glucose concentrations were generally high and displayed a seasonal pattern with variations being accompanied by corresponding changes in rates of glucose uptake by bacteria. A relationship between dissolved glucose and carbon fixation was found to exist at the upper station but diminishes toward the lower stations. It is believed that this is most likely the result of increased mixing by wind action. (Heany-Florida)
W79-05397

INFLUENCE OF WASTE RESIDUALS IN ESTUARINE WATERS ON DEVELOPMENT, BEHAVIOR AND SURVIVAL OF SOFT-SHELL CLAM LARVAE,
Massachusetts University, Amherst. Department of Forestry and Wildlife Management.
C. Gledhill, C. F. Cole, and C. Martin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 606, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Massachusetts, Publication No 99, 1978. 37 p, 7 fig, 8 tab, 47 ref. OWRT A-111-MASS(1). 14-34-0001-8023.

Descriptors: Biological communities, Competition, *Mollusks, *Estuaries, *Clams, *Water pollution effects, Benthic fauna, Marine animals, Estuarine environment, Shellfish, Mya arenaria.

The effects of waste effluents on soft-shell clam (Mya arenaria) larval and spat survival were studied at one polluted and one unpolluted site. Soft-shell clam larval abundance in the plankton was determined at the two sites in 1977 and 1978, together with the temperature, salinity, and dissolved oxygen of the surface water. The two flats were sampled in 1978 to obtain correlations between the infaunal species and soft-shell clams. Field experiments were conducted to determine the effect of one member of the infauna, Gemma gemma, on settlement of soft-shell clams. Significantly more larvae were found at the unpolluted site in 1977, but no differences in abundance occurred in 1978. Larval abundance was not correlated with temperature, salinity or dissolved oxygen. Sampling of the flats indicated negative correlations between soft-shell clams and the following species: Gemma gemma, Hydrobia minuta, Drilonereis longa, Paranois fulgens, and Nereis diversicolor, all of these species being more abundant at the polluted site. Field experiments showed a significant negative relationship between soft-shell clam settlement and high densities of gem clams. The study indicates the possibility that waste effluents can adversely affect recruitment of soft-shell clams by changing the biota to species detrimental to soft-shell clams.
W79-05398

TOXICITY OF TREATED AND UNTREATED P. (PINUS) RADIATA TMP (THERMOMECHANICAL PULPING) EFFLUENTS ON A NUMBER OF ORGANISMS,
Gutteridge, Haskins and Davey (Pty) Ltd., Melbourne (Australia).
R. T. Buckney.
Appita, Vol. 32, No. 2, p 129-133, September, 1978.

Descriptors: *Pulp wastes, *Toxicity, *Aquatic life, *Water pollution effects, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Activated sludge, Waste water treatment, Pine trees, Aquatic animals, Fish, Aquatic insects, Aquatic plants, Mollusks, Foreign countries, Thermomechanical pulping, Pinus radiata, Australia.

Acute lethal and sublethal bioassay procedures were implemented at the request of Australian Newspring Mills Ltd. to compare the toxicity of raw and activated sludge-treated Pinus radiata thermomechanical pulping effluents. Raw effluent was highly toxic at concentrations of 5-10% in clean water. The activated sludge process successfully eliminated this toxicity. Organisms included in the bioassay program were aquatic plants and insects, bivalve molluscs, and fish. (Swichtenberg-IPC)
W79-05426

OBSERVATIONS ON HYPNOSPORES IN ULOTHRIX ZONATA (CHLOROPHYCEAE),
Miami Univ., Oxford, OH. Dept. of Botany.
K. W. Bullock.
Canadian Journal of Botany, Vol. 56, No. 14, p 1660-1664. July 1978, 10 fig, 26 ref.

Descriptors: *Hypnospores, *Ulothrix zonata, *Reproduction, *Asexual reproduction, *Plant growth, *Cytological studies, *Plant physiology, *Plant morphology, Algae, Chlorophyta, Spores, Zoospores, Cytoplasm, Vegetative filaments, Terminology, Electron microscopy.

The formation, structure, and development of hypnospores in the chlorophyte alga Ulothrix zonata are described, based on light and electron microscopy; the presence of hypnospores in this species represents a unique form of asexual reproduction among members of the genus Ulothrix. Hypnospores are formed by cleavages similar to those in zoosporogenesis, but not all of the parent cell cytoplasm is included in the hypnospores. The latter lack flagella or an eyespot, and possess a thick, dense cell wall (the pyrenoid), which together with the nuclear morphology of hypnospores, closely resemble vegetative cells. Production varies within an individual filament 2-4 large hypnospores per cell to as many as 32 smaller hypnospores per cell. Hypnospores are retained within the parent wall where they germinate into multicellular filaments. Subsequent growth of the filaments ruptures the parent cell wall, whereupon the filaments are released and settle on the substrate to continue growth. Recently released filaments are

indistinguishable from those produced by zoospore germination or fragmentation of a vegetative filament. Hypnospores have previously been named parthenospores, microgonidia, and macrogonidia, but none of these names accurately denote their formation and morphology. (Lynch-Wisconsin)
W79-05428

VARIABILITY OF ANNUAL NUTRIENT AND SEDIMENT DISCHARGES IN RUNOFF FROM OKLAHOMA CROPLAND AND RANGELAND,
Agricultural Research Service, Durant, OK. Water Quality Management Lab.
R. G. Menzel, E. D. Rhoades, A. E. Olness, and S. J. Smith.
Journal of Environmental Quality, Vol. 7, No. 3, p. 401-406, July-September 1978. 4 fig, 4 tab, 23 ref.

Descriptors: *Oklahoma, *Ranges, *Crop production, *Nutrients, *Sediments, *Agricultural runoff, *Water quality control, Pastures, Nitrogen, Phosphorus, Nitrates, Phosphates, Soil types, Chickasha(OK), Land use, Fertilization, Grazing, Cotton, Wheat, Watersheds(Basins), Farm management, Water pollution sources, Water pollution control, Rainfall, Soil erosion.

Annual variations in nutrient and sediment discharges may be as great as those due to different land uses or fertilizer additions, according to comparison of results from a four-year study (1972-76) of relationships between nutrient, water, and sediment discharges from cropland and rangeland in central Oklahoma with 1966-76 records of water and sediment discharges. Long historical records of a decade or more are therefore necessary to meaningfully evaluate treatments designed to control nutrient and sediment discharges. Average annual nutrient concentrations in runoff, though greatly variable, are reasonably predictable on the basis of runoff volume, sediment discharge, soil characteristics, and fertilization history. Six 5-18 ha watersheds near Chichasha, Oklahoma were studied; two were cropped continuously with cotton and two with wheat (all nearly level), and two were grazed at different intensities (3% slope). Average annual sediment discharged was 3600 kg/ha (8900 maximum) from irrigated cotton, 900 kg/ha (3900 maximum) from dryland wheat, 400 kg/ha (1800 maximum) from range with limited grazing, and 9000 kg/ha (23,000 maximum) from overgrazed range. Maximum annual nutrient discharges were 13 kg total N/ha, four kg nitrate-N/ha, 11 kg total P/ha, and two kg soluble P/ha. Average annual discharge for each nutrient was about half of these maximum values. (lynch-Wisconsin)
W79-05429

WATER CHLORINATION: ENVIRONMENTAL IMPACT AND HEALTH EFFECTS.
Volume 2, Proceedings of the Second Conference on the Environmental Impact of Water Chlorination, Gatlinburg, Tennessee, October 31-November 4, 1977. Jolley, R.L., Gorchev, H and Hamilton, D.H., Jr. (Eds.). Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1978. 909 p.

Descriptors: *Conferences, *Chlorination, Environmental effects, Public health.

The conference proceedings contains 66 papers related to the subject of water chlorination and 6 workshop and conference summaries. Areas of interest include chemistry of freshwater systems, environmental effects in freshwater systems, chemistry of marine systems, environmental effects in marine systems, health effects, drinking water treatment, wastewater treatment and alternatives to chlorination, cooling water treatment and alternatives to chlorination, industrial effluents, and regulations concerning the practice of chlorination. (See W79-05436 thru W79-05495) (Chilton-ORNL)
W79-05435

NATURAL AND MODEL AQUATIC HUMICS: REACTIONS WITH CHLORINE,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
R. F. Christman, J. D. Johnson, J. R. Hass, F. K. Pfaender, and W. T. Liao.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H.,Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 15-28, 1978 6 fig, 2 tab, 17 ref.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Freshwater, Chemistry, Analytical techniques.

This report summarizes initial findings of a study which includes the isolation, concentration and chemical degradation of natural humic material and the controlled laboratory reaction of phenolic model compounds with chlorine. From a 500 gal. sample of lake water, humic material was isolated and concentrated to 20 liters of humic-hymatomelanic fraction and 10 liters of fulvic acid fraction. Elemental analysis of further purified humic-hymatomelanic acid solids revealed a C:H:O:N ratio of 1.0:1.17:0.61:0.05. Products of degradation of humic-hymatomelanic acid are listed. The only model compound chlorination investigation reported was resorcinol. Chloroform production was measured at various resorcinol concentrations and it was noted that as the Cl/C ratio increased, relative chloroform production increased linearly up to a ratio value of 1.14 + or - 0.09 Data indicated that free residual chlorine exists beyond this value. GC/MS analysis of ether extracts of reaction mixtures before the endpoint revealed the presence of a cyclopentene derivative which increased in concentration as the concentration of resorcinol increased and is believed to be the principal product formed in addition to chloroform. The cyclopentene disappears at the reaction endpoint. No other nonpolar products were detected past the endpoint. (See also W79-05435) (Chilton-ORNL)
W79-05437

AQUEOUS CHLORINATION OF SOME PHENOLIC ACIDS,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
A. L. Rockwell, and R. A. Larson.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr. (Eds.). Proceedings of Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 67-74, 1978 2 fig, 16 ref.

Descriptors: *Chlorination, *Water pollution, Freshwater, Chemistry, Water chemistry, Phenols.

An investigation of the formation of chlorophenols from chlorination of waters containing phenolic acids is reported. Aqueous chlorination and decarboxylation of aromatic acids occurred in two steps. Addition of chlorine from hypochlorite to an aromatic ring was electrophilic and thus favored by electron-donating sustituents. In decarboxylation an intermediate with a negative charge is generated. Delocalization of this charge by resonance to the aromatic carbon atoms ortho to the phenolate group is favored by electron-withdrawing substituents. Kinetic data and product analyses are in accord with the proposed mechanism. (See also W79-05435) (Chilton-ORNL)
W79-05441

A PROGRAM TO INTRODUCE SITE-SPECIFIC CHLORINATION REGIMES AT ONTARIO HYDRO GENERATING STATIONS,
Ontario Hydro, Toronto.
J. A. Grieve, L. E. Johnston, T. G. Dunstall, and J. Minor.
In: Water Chlorination, Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H., and Hamilton, D.H.,Jr. (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 77-94, 1978 14 fig, 13 ref.

Descriptors: *Environmental effects, *Chlorination, Water pollution, Analytical techniques, Fish, White bass, Discharge(Water), Sites, Stations.

The purpose of this study was to develop site-specific chlorination regimes which would optimize station efficiency compatible with its operating mode while ensuring environmental stability. Parameters considered were chlorine plume (size and decay), effect of chlorine discharges on fish (specifically white bass), and analytical methods for determination of low chlorine concentrations. Dilution in the outfall channel and dispersion and reaction in the plume resulted in rapid decay in chlorine concentration. Extent of the chlorine plume could be calculated to a first approximation by using site-specific chlorine reaction factors. Fish movement studies showed that white bass take avoidance action during short-term chlorination in excess of 35 microg/l. Acceptable total residual chlorine level was between 35 microg/l and 50 microg/l in the outfall channel. Evaluation of analytical technique showed that Orion potentiometric and the Delta scientific method were not as sensitive or accurate as the Princeton applied research method. (See also W79-05435) (Chilton-ORNL)
W79-05442

A PRELIMINARY LOOK AT THE EFFECTS OF INTERMITTENT CHLORINATION ON SELECTED WARMWATER FISHES,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies; and Wisconsin Univ.-Milwaukee. Dept. of Zoology.
A. S. Brooks, and G. L. Seegert.
In: Water Chlorination, Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H., and Hamilton, D.H.,Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 95-109, 1978. 5 tab, 19 ref.

Descriptors: *Environmental effects, *Chlorination, *Fish, Water pollution, Freshwater fish, Carp, Sunfishes, Shiners, Mortality, Fish behavior.

Five species of freshwater fish (emerald shiner, Notropis antherimoides; common shiner, Notropis cornutus; spotfin shiner, Notropis spilopterus; bluegill, Lepomis macrochirus; and carp, Cyprinus carpio) were tested for their resistance to quadruple 40-min exposures of monochloramine. All species were lethargic during exposure but usually behaved normally between exposures with this behavior being especially pronounced in carp. Mortalities occurred most rapidly in spotfin and emerald shiners, were intermediate in common shiner and carp and slowest in bluegill. Mucus loss was a general response in all five species with the degree of occurrence being influenced by exposure time, concentration, chlorine form and fish species. All five species tested showed an inverse relationship between temperature and resistance to monochloramine. (See also W79-05435) (Chilton-ORNL)
W79-05443

TOWARD AN UNDERSTANDING OF THE TOXICITY OF INTERMITTENT EXPOSURES OF TOTAL RESIDUAL CHLORINE TO FRESHWATER FISHES,
Oregon State Univ., Corvallis. Oak Creek Lab. of Biology.
G. L. Larson, and D. A. Schlesinger.
In: Water Chlorination, Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H., and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 111-122, 1978. 4 fig, 1 tab, 9 ref.

Descriptors: *Environmental effects, *Chlorination, *Fish, Water pollution, Freshwater fish, Bass, Largemouth bass, Toxicity.

Acute toxicity, and the effect of temperature on acute toxicity, on largemouth bass of total residual chlorine at different concentrations, exposure durations and frequencies was evaluated. Groups of largemouth bass were exposed to high-spike pattern of exposure, low-spike pattern of exposure and square pattern of exposure. Relationships between mortality and the area under the time-concentration exposure curve were not significantly different for the three patterns. Intervals between exposures were only two hours for fish receiving two 90-min exposures and this was not enough time for recovery. Temperature was shown to influence toler-

ance with fish being more tolerant at 13.1 C than at 24.3 C. It was concluded that sudden increase in temperature over acclimation temperature decreases the tolerance of fish to residual chlorine compounds. (See also W79-05435) (Chilton-ORNL)
W79-05444

INFLUENCE OF CHLORINE FORM AND AMBIENT TEMPERATURE ON THE TOXICITY OF INTERMITTENT CHLORINATION TO FRESHWATER FISH,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
A. G. Heath.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H., and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 123-133, 1978 6 fig, 2 tab, 9 ref.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Temperature, Fish, Mortality, Toxicity, Freshwater, Trout, Salmon, Sunfishes, Shiners, Channel catfish.

Bioassays using death as the endpoint were conducted on rainbow trout, coho salmon, golden shiner, bluegill and channel catfish which had been exposed to intermittent chlorination at various temperatures. At median lethal concentrations, there was a slight temperature effect on free chlorine toxicity to rainbow trout, bluegill and channel catfish and a greater effect on golden shiners. Temperatures in the middle of the tolerance, one caused a slightly greater sensitivity to chlorine in trout and bluegills. No significant differences in LC50 values at different temperatures for monochloramine pulses were observed in salmon or catfish. Shiners exhibited an inverse temperature effect for monochloramine pulses. 0.5 mg/l TRC (total residual chlorine) with 0.38 mg/l free chlorine resulted in 50% death with only one chlorination pulse but a chloramine pulse of 0.5 mg/l with no free chlorine gave an LT50 of 40 pulses. A 3.3-4.5 fold difference in TRC LC50 values was found between free chlorine and monochloramine doses in trout, coho and golden shiners. Channel catfish showed greater sensitivity to chloramine than other species but were still less affected by chloramine than free chlorine. (See also W79-05435) (Chilton-ORNL)
W79-05445

THE USE OF VARIOUS AVOIDANCE INDICES TO EVALUATE THE BEHAVIORAL RESPONSE OF THE GOLDEN SHINER TO COMPONENTS OF TOTAL RESIDUAL CHLORINE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
S. R. Larrick, D.S. Cherry, K. L. Dickson, and J. Cairns, Jr.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H., and Hamilton, D.H.,Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 135-147, 1978. 4 fig, 1 tab, 24 ref.

Descriptors: *Environmental effects, *Chlorination, Fish behavior, Shiners, Temperature, Fish, Water pollution, Avoidance response, Acclimation temperature.

The objectives of this study were to evaluate standardized methods and indices for chlorine avoidance investigations; to determine if avoidance behavior is correlated with a specific component of the total residual; and to evaluate the influence of acclimation temperature on avoidance behavior by golden shiners. Total residual chlorine (TRC), free residual chlorine (FRC), and combined residual chlorine (CRC) avoidance thresholds varied with acclimation temperature, being similar at 12, 18 and 30C and maximal at 24C. HOCl avoidance thresholds were consistent with acclimation temperature, varying from 0.015-0.017 mg/l. It was concluded that the hypochlorous acid fraction of the total residual chlorine directs golden shiner chlorine avoidance behavior. (See also W79-05435) (Chilton-ORNL)
W79-05446

AVOIDANCE OF MONOCHLORAMINE: TEST TANK RESULTS FOR RAINBOW TROUT, COHO SALMON, ALEWIFE, YELLOW PERCH AND SPOTTAIL SHINER,
WAPORA, Inc. Washington, DC.
R. B. Bogardus, D. B. Boies, T. C. Teppen, and F. J. Horvath.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H., and Hamilton, D. H., Jr., (Eds). Proceedings of Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 149-161, 1978. 2 fig, 7 ref.

Descriptors: *Environmental effects, *Chlorination, *Water pollution, Fish, Fish behavior, Trout, Salmon, Shiners, Yellow perch, Chlorine, Toxicity, Schools(Fish), Avoidance response.

All species tested in this study showed a tendency toward increasing avoidance as the concentration of monochloramine was gradually increased. All species exhibited either schooling or gregarious behavior which was important in the avoidance response of the species. Distress signs were occasionally observed in all species but no deaths occurred during testing. Juvenile coho salmon exhibited teritoriality which had important ramifications upon their avoidance response. It was concluded that avoidance is a characteristic of chlorine toxicity in combination with level of detection, conditioned or learned response and acclimation, and cannot be relegated to a rigid, precise code of behavior. (See also W79-05435) (Chilton-ORNL)
W79-05447

INVESTIGATION OF THE EFFECTS OF HALOGENATED ORGANIC COMPOUNDS PRODUCED IN COOLING SYSTEMS AND PROCESS EFFLUENTS ON AQUATIC ORGANISMS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
J. R. Trabalka, and M. B. Burch.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H., and Hamilton, D.H.,Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 163-173, 1978. 4 tab, 18 ref.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Freshwater, Toxicity, Carp, Embryonic growth stage, Daphnia, Sewage effluents, Cooling water, Chlorophenol.

Tests were conducted for three synthetic effluents based on identifications from sewage effluent and cooling waters. Embryos of carp (Cyprinus carpio) and the cladoceran (daphnia pulex) were used in the studies. Results of tests on carp embryos showed a trend in comparative toxicity (LC50 for secondary sewage effluent < Mississippi River cooling water < Watts Bar Reservoir cooling water). 96-hr LC50 values for Daphnia pulex exposed to the effluents showed toxicity of the synthetic secondary sewage effluent > Mississippi River cooling water > Watts Bar Reservoir cooling water. It was concluded that the toxicity of the chloro-organics tested was primarily attributable to its chloro-phenol content and that acute toxicity was demonstrable in the carp embryo and Daphnia pulex at levels approximately three orders of magnitude greater than those expected in actual effluents. (See also W79-05435) (Chilton-ORNL)
W79-05448

BROMINATED COMPOUNDS FOUND IN WASTE-TREATMENT EFFLUENTS AND THEIR CAPACITY TO BIOACCUMULATE,
Environmental Research Lab., Duluth, MN.
D. W. Kuehl, G. D. Veith, and E. N. Leonard.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H., and Hamilton, D.H. Jr. (Eds). Proceedings of Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 175-192, 1978 6 fig, 3 tab, 17 ref.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Bromine, Water treatment, Disinfection, Fish, Absorption, Bioaccumulation.

Fathead minnows exposed to bromine-chloride-treated and nondisinfected effluent were analyzed. This analysis resulted in the isolation and identification of a series of brominated phenols, anisoles and heterocyclic and heterocyclic aromatics. Although the organobromine residues were observed at concentrations at least an order of magnitude less than the toxic chemicals such as PCB and chlordane that were present in the raw wastes, the smaller bioconcentration factors for the polar brominated chemicals suggest that measurable water concentrations of these chemicals are likely to be present in chlorobrominated wastewater. It was recommended that the aqueous chemistry of bromination of organic chemicals and measurement of the products in wastewaters be studied to determine if chlorobromination is more advantageous than chlorination with respect to the halogenated chemicals produced. (See also W79-05435) (Chilton-ORNL)
W79-05449

REACTIONS IN CHLORINATED SEAWATER,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
For primary bibliographic entry see Field 5A.
W79-05450

DDT, PCB AND CHLORINATED BENZENES IN THE MARINE ECOSYSTEM OFF SOUTHERN CALIFORNIA,
Southern California Coastal Water Research Project, El Segundo.
D. R. Young, and T. C. Heesen.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr. (Eds.). Proceedings of a Conference, Gatlinburg, Tennessee, October 31-November 4, 1977, p 267-290, 1978. 5 fig, 6 tab, 29 ref. EPA R 803707.

Descriptors: *Chlorination, *Water chemistry, Chlorine, Chlorinated hydrocarbon pesticides, DDT, Polychlorinated biphenyls, Environmental effects, Water pollution, Waste water(Pollution), Sediments, Fish.

Findings on DDT and PCB inputs, distributions and impacts are compared with results on chlorinated benzenes in the same ecosystem. DDT, PCB and chlorinated benzene concentrations in flat fish residing near a major municipal outfall were related to concentration of these compounds in the sediments. Contamination of sediments by DDTs and PCBs was seen to result in persistent contamination of marine organisms after major reductions in dominant inputs occurred. DDT residues of >5 ppm in bottom feeding fish appear to have caused deaths of captive marine birds feeding on these fish for more than a year. Unchlorinated municipal wastewaters were the dominant source of chlorinated benzenes in the Bight. Differences between input rates of DDT, PCB and chlorinated benzenes and concentration of corresponding compounds present in resident fish are partially explained by higher inputs of DDT and PCB residues in the past. High solubilities and bio-accumulation factors are also of importance. (See also W79-05435) (Chilton-ORNL)
W79-05455

BIOLOGICAL AND CHEMICAL EFFECTS OF CHLORINATION AT COASTAL POWER PLANTS,
Woods Hole Oceanographic Institution, MA.
J. C. Goldman, J. M. Capuzzo, and G. T. F. Wong.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 291-305, 1978. 8 fig, 10 ref. ERDA E(11-1)-2532.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Sea water, Powerplants, Coasts, Phytoplankton, Zooplankton, Larval growth stage, Chemistry.

This report reviews research findings and offers recommendations on chlorination practice at coastal power plants. The complexity of the chemistry of chlorine in sea water is discussed and concern is expressed over the potential toxicity of unidentified compounds. It was concluded that chlorination effects on larval zooplankton at power plants is more serious than effects on phytoplankton. Growth rates of some commercially important species were found to be seriously retarded after exposure to sublethal chlorine concentrations while phytoplankton growth rates of recovered cells did not appear to be permanently affected. It was suggested that the practice of dechlorination immediately after entrainment should be considered. (See also W79-05435) (Chilton-ORNL)
W79-05456

TOXICITY SCREENING OF FIFTEEN CHLORINATED AND BROMINATED COMPOUNDS USING FOUR SPECIES OF MARINE PHYTOPLANKTON,
Environmental Protection Agency, Gulf Breeze, FL.; and Environmental Research Lab., Johns Island, SC. Bears Bluff Field Station.
S. J. Erickson, and A. E. Freeman.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 307-310, 1978. 1 tab, 3 ref.

Descriptors: *Chlorination, *Toxicity, Algae, Sea water, Marine algae, Environmental effects, Water pollution, Phytoplankton.

The toxicity screening tests investigated in this work were performed on Skeletonema costatum, Thalassiosira pseudonana, Glenodinium halli, and Isochrysis galbana. The concentration of test compounds which inhibited or stimulated cell division were determined and are presented in tables. All four species of algae responded to the compounds in a like manner. Monochloramine was the most inhibitory compound tested. Halogenated phenols gave varied responses. At the concentrations tested, p-chlorophenol and 2,4,6-tribromoanisole yielded no toxic effects. Five compounds were growth inhibitory (p-bromophenol < 2,4,6-tribromoanisole < 2,4,6-trichlorophenol < pentachlorophenol < pentabromophenol). Pentachlorophenol and pentabromophenol were highly inhibitory. The halogenated hydrocarbons were all stimulatory to the algae. (See also W-79-05435) (Chilton-ORNL)
W79-05457

SEASONAL CHRONIC TOXICITY OF CHLORINATION TO THE AMERICAN OYSTER, CRASSOTREA VIRGINICA (G),
Environmental Protection Agency, Gulf Breeze, FL.; and Environmental Research Lab., Johns Island, SC. Bears Bluff Field Station.
G. I. Scott, and D. P. Middaugh.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 311-328, 1978. 7 fig, 3 tab, 22 ref.

Descriptors: *Environmental effects, *Chlorination, Water pollution, Oysters, Toxicity, Seasonal, Mortality, Temperature, Feeding.

In order to assess the effects of chronic exposure of oysters to chlorination the following measurements were made: daily percentage survival; shell height prior to and at the end of each seasonal exposure; growth; and condition index as determined by the Galtsoff method. Results indicated that chronic exposures of C. virginica to chlorine-produced-oxidant (CPO) products can produce considerable mortality at high concentrations and severe sublethal effects at lower levels. Toxicity is related to seasonal changes in measured CPO concentrations, temperature and the physiological condition of the oyster. Sublethal effects appeared to be related to reductions in feeding and increased avoidance of CPO. This resulted in reduced tissue production causing severe reductions in the size of gonadal tissues as well as increased dependence upon glycogen reserves during exposures to CPO. (See also W79-05435) (Chilton-ORNL)
W79-05458

EFFECTS OF CHLORINATED SEA WATER ON DECAPOD CRUSTACEANS,
Virginia Inst. of Marine Science, Gloucester Point.
M. H. Roberts, Jr.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 329-339, 1978. 4 fig, 3 tab, 2 ref. EPA R 803872-01 & R 803872-02.

Descriptors: *Environmental effects, *Chlorination, Water pollution, Crabs, Embryonic growth stage, Larvae, Toxicity, Seasonal, Resistance.

Eggs and larvae of Panopeus herbstii and Pagurus longicarpus were exposed to reasonably uniform concentrations of chlorine-induced-oxidants (CIO) in a continuous flow system. Data indicated Panopeus herbstii eggs were more tolerant of CIO than larvae. Larvae of both species were more sensitive than adults. Zoeal stages have a relatively poorly calcified exoskeleton which is more permeable than the egg membrane and larvae are especially sensitive to toxicants during molting. It was noted that there is an apparent seasonal change in the acutely toxic dose for P. herbstii zoeae, with larvae produced late in the normal breeding season being more sensitive than those produced during the rest of the breeding season. (See also W79-05435) (Chilton-ORNL)
W79-05459

THE RELATIVE SENSITIVITY OF PACIFIC NORTHWEST FISHES AND INVERTEBRATES TO CHLORINATED SEA WATER,
Battelle Pacific Northwest Labs. Sequim, WA. Marine Research Labs.
T. O. Thatcher.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, TN., p 341-350, 1978. 1 tab, 20 ref. ERDA EY-76-C-06-1830.

Descriptors: *Environmental effects, *Chlorination, Water pollution, Sea water, Toxicity, Fish, Invertebrates, Mortality.

The relative sensitivity of 8 fish and 7 invertebrate species to chlorinated sea water was determined using a series of 96-hr LC50 continuous flow bioassays. Fish were generally more sensitive than invertebrates. Three rather distinct groups with differing sensitivity were observed. The most sensitive group (exhibiting 96-hr LC50 values from 0.026 mg/l total residual ovidant (TRO) up to 0.119 mg/l TRO) included 3 salmon species, Pacific herring, shiner perch, English sole, Pacific sand lance and Pandalus goniurus. Intermediate sensitivity (96-hr LC50 values ranging from 0.118 mg/l TRO to 0.199 mg/l TRO) was shown by Crangon nigricauda, amphipod (Anonyx sp.), mysid (Neomysis sp) threespine stickleback, and coon stripe shrimp. The most resistant group (96-hr LC50 values ranging from 0.583 mg/l TRO to 1.530 mg/l TRO) consisted of two invertebrates, the amphipod (Pontogeneia sp) and shore crabe (Hemigrapsus nudus and H. oregonesis). It was observed that the mortality/concentration curves are parallel for all species tested suggesting that the same mechanism of toxicity is producing mortality. (See also W79-05435) (Chilton-ORNL)
W79-05460

RESPIRATORY AND OSMOREGULATORY RESPONSES OF WHITE PERCH (MORONE AMERICANA) EXPOSED TO CHLORINE AND OZONE IN ESTUARINE WATERS,
Tetra Tech, Inc. Lafayette, CA.
R. M. Block, D. T. Burton, S. R. Gullans, and L. B. Richardson.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H. Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 351-360. 1978. 2 tab, 10 ref. EPA R 804683010 and Md. Power Plant Siting Prog. 25-75-04(77).

Descriptors: *Chlorination, *Environmental effects, Water pollution fish, White perch, Chlorine, Ozone, Respiration, Animal physiology, Mortality.

One of the most striking results of these investigations into the relative toxicity of chlorine and ozone to white perch was that all fish exposed to ozone died shortly after 6 hours of exposure while no mortality was observed until after 8 hours in fish exposed to chlorine. Histological studies showed pathological damage to gill tissue from both ozone and chlorine exposure. It was concluded that the mode of action of both toxicants' is the same in that osmoregulatory and respiratory mechanism are affected in the same manner. Blood pH and plasma osmolarity are identified as sensitive indicators of oxidant stress. (See also W79-05435) (Chilton-ORNL)
W79-05461

CONTINUOUS LOW-LEVEL CHLORINATION FOR MARINE FOULING CONTROL AT POWER STATIONS IN THE UNITED KINGDOM,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
J. W. Whitehouse.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, TN., p 361-367, 1978. 6 tab, 2 ref.

Descriptors: *Environmental effects, *Chlorination, *Water pollution, Mussels, Cooling water, Mortality, Chlorine, Intakes, Screens, Iron.

This paper describes experiments using Mytilus edulis L. as the test organism with ferrous sulfate-treated sea water and studies of intake screen debris which assess the extent of fouling control. Data from batch-treated experiments indicated that ferrous sulfate depressed foot activity and byssus production in M. edulis by comparison with untreated water. Long-term experiment on byssus thread production showed that ferrous sulfate did not reduce the counts of threads/animal/day by comparison with untreated animals and there was no significant difference in thread production between treatments. Examination of screen washing debris showed that at the start-up of chlorination in the spring, 400 starfish of 20-200 mm size were caught on the screens within an hour of venting chlorine. A similar number were caught the following day when continuous schedule was begun but debris examined 3 months later revealed no starfish in a 13-hr sampling period. Mussels collected in spring were nearly all empty shell. Live mussels were found in the debris in summer suggesting that a thriving population exists within the cooling tunnels. (See also W79-05435) (Chilton-ORNL)
W79-05462

RESPONSE OF ENTRAINED PLANKTON TO LOW-LEVEL CHLORINATION AT A COASTAL POWER STATION,
Central Electricity Generating Board, Southampton (England). Marine Biological Lab.; and Central Electricity Generating Board, Fawley (England). Fawley Power Station.
M. H. Davis, and J. Coughlan.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlin-

burg, TN., p 369-376, 1978. 1 fig, 2 tab, 16 ref.

Descriptors: *Environmental effects, *Chlorination, Plankton, Cooling water, Chlorine, Mortality, Photosynthesis, Nuclear powerplants.

This paper reports field investigations of the side effects of chlorination on plankton pumped through the cooling system of a nuclear power station. Adult copepods, copepod and barnacle nauplii comprised 95% of the samples taken. Immediate mortality of these three groups was low; 48 hrs later mortality increased, particularly at chlorine concentrations above 0.5 ppm. Depression of photosynthetic activity increased with chlorine concentration, reaching 95% at 1.0 ppm. The 3-hr EC50 (effective initial concentration for 50% reduction in productivity) was 0.09 ppm. Bacterial activity virtually ceased when chlorination was in progress. It was concluded that side effects of chlorination on phytoplankton warrant further investigation. (See also W79-05435) (Chilton-ORNL)
W79-05463

THE EPIDEMIOLOGIC APPROACH TO THE EVALUATION OF ORGANICS IN DRINKING WATER,
Environmental Protection Agency, Cincinnati, OH.
K. P. Cantor, and L. J. McCabe.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 379-391. 1978. 3 tab, 23 ref.

Descriptors: *Chlorination, *Public health, *Epidemiology, Water pollution, Reviews, Water pollution effects, Human diseases.

This paper reviews the background against which current studies on the epidemiologic method as applied to the evaluation of health risks of waterborne carcinogens will be reviewed and suggests directions for future research. Problems involved in epidemiologic methods are discussed and individual studies are reviewed. (See also W79-05435) (Chilton-ORNL)
W79-05464

A CASE CONTROL STUDY OF GASTROINTESTINAL AND URINARY TRACT CANCER MORTALITY AND DRINKING WATER CHLORINATION,
Hunter Coll., New York. School of Health Sciences.
M. Alavanja, I. Goldstein, and M. Susser.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr. (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 395-409. 1978. 6 tab, 7 ref.

Descriptors: *Chlorination, *Environmental effects, *Public health, Disease, Water pollution, Water pollution effects, Water pollution sources, Human diseases, Mortality, New York.

In this study a total of 3446 gastrointestinal and urinary tract cancer mortalities and 3444 individually matched controls were analyzed. Inadequate water quality data in the seven counties represented in the study prevented the making of a definitive claim that chlorination was directly or indirectly responsible for the greater risk of cancer mortality in chlorinated water areas. The following conclusions were drawn: Males living in chlorinated water areas of Erie, Rensselaer and Schenectady counties (N.Y. state) and females living in the chlorinated water areas of Erie and Schenectady counties are at a greater risk of gastrointestinal and urinary tract cancer mortality than are individuals living in nonchlorinated water areas. This excess risk of GI and UT cancer is not due to a disparity in the age, race, or ethic distribution of the population or to an urban/rural factor, hazardous occupation, inorganic carcinogens or a surface/ground water difference. (See also W79-05435) (Chilton-ORNL)
W79-05465

MUTAGENICITY AND WATER CHLORINATION: PROSPECT AND PERSPECTIVE,
Oak Ridge National Lab., TN.
R. B. Cumming.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 411-416. 1978. 6 ref.

Descriptors: *Chlorination, *Public health, Environmental effects, Water pollution, Water pollution effects, Water pollution sources, Human diseases, Genetics.

This paper presents an overview of mutagenicity and mutagenicity tests and the extent to which they are relevant to the assessment of water chlorination's impact on public health. The areas discussed include genetic toxicology, the relationship between mutagenesis and carinogenesis, and the indirect health effects on humans of mutation and selection processes. It was concluded that mutagenesis is a difficult area to put into perspective due to the fact that there are too many loose ends in the field. Data shows that it is, however, an important toxicological end point. (See also W79-05435) (Chilton-ORNL)
W79-05466

THE MUTAGENIC ACTIVITY OF HALOGENATED COMPOUNDS FOUND IN CHLORINATED DRINKING WATER,
SRI International, Menlo Park, CA.
V. F. Simmon, and R. G. Tardiff.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, TN., p 417-431, 1978. 16 fig, 20 ref. EPA 68-03-11-74.

Descriptors: *Chlorination, *Public health, Potable water, Water pollution sources, Water pollution, Human diseases, Genetics, Environmental effects.

In this study, 22 halogenated compounds were assayed for mutagenic activity by the Ames Salmonella/microsome procedure. Although CCl4 and CHCl3 are recognized carcinogens in rodents, the investigators were unable to establish a dose-dependent or time dependent increase in the number of mutants. Known carcinogens that were mutagenic were vinyl chloride, vinylidene chloride, 1,2-dichloroethane, 1,1,2-trichloroethylene, bis(2-chloroethyl) ether, methyl iodide, and bromoform. Bromodichloromethane and chlorodibromomethane, which have not been tested for carcinogenic activity, were found to be mutagenic. The halomethanes were all mutagenic. Within each class of chemicals, mutagenic activity was proportional to chemical reactivity. It was concluded that the high correlation between chemicals that are mutagenic and carcinogenic and the evidence that mutagens are deleterious indicate that the number and amount of alkyl halides in potable water should be reduced. (See also W79-05435) (Chilton-ORNL)
W79-05467

MUTAGENICITY OF COMPLEX MIXTURES FROM DRINKING WATER,
Cincinnati Univ., OH. Dept. of Microbiology.
J. C. Loper, D. R. Lang, and C. C. Smith.
In: Water Chlorination: Environmental Impact and Health Effects, Vol 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr. (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 433-450. 1978. 6 fig, 6 tab, 12 ref. EPA R804202.

Descriptors: *Chlorination, *Public health, Environmental effects, Water pollution, Water pollution sources, Human diseases, Genetics, Potable water.

Samples of organic residues isolated from drinking water by the reverse osmosis procedure were assayed for their mutagenic activity. This study clearly indicates that these residues produce mutagenesis in Salmonella tester strains. The residues and subfractions from water of different cities show city-specific patterns which are relatively stable form samples taken at 2 - 3 month intervals. Indications of mutagenic or carcinogenic activity in these mixtures can be compared with similar data being generated with known constituents of drinking water to make possible the detection of comutagenic, cocarcinogenic or antagonistic activities of components in the mixtures. (See also W79-05435) (Chilton-ORNL)
W79-05468

A PRIORI PREDICTIVE METHODS OF ASSESSING HEALTH EFFECTS OF CHEMICALS IN THE ENVIRONMENT,
California Univ., Berkeley. Lawrence Berkeley Lab.
M. J. Kland.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 451-469. 1978. 7 fig, 2 tab, 23 ref.

Descriptors: *Chlorination, *Public health, Environmental effects, Water pollution, Chemicals, Chemical wastes, Forecasting.

Four techniques (structure/activity relationships (SAR), factor analysis(FA), pattern recognition(PR), and molecular connectivity(MC)) for assessing the multifactorial problems of toxicity and carcinogenicity are described. It was concluded that none of these techniques provides easy answers but that PR and MC both merit more intensive investigation as predictive tools. (See also W79-05435) (Chilton-ORNL)
W79-05469

DEVELOPMENT OF RESISTANT POLIOVIRUS BY REPETITIVE SUBLETHAL EXPOSURE TO CHLORINE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
R. C. Bates, S. M. Sutherland, and P. T. B. Shaffer.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 471-482. 1978. 5 fig, 1 tab, 14 ref.

Descriptors: *Chlorination, *Public health, Water pollution, Water pollution sources, Chlorine, Resistance, Viruses, Genetics.

The studies reported here indicate that a laboratory strain of poliovirus can be made more resistant to chlorine inactivation by a procedure which either selects for a resistant subpopulation of the parental population or by a direct mutagenic action of the halogen on the virus to produce a resistant variant. Not only does the virus develop increased resistance to chlorine inactivation but other phenotypic characteristics such as plaque size and morphology change, indicating the possibility that increased resistance to chlorine inactivation could be accompanied by genetic changes which alter the virulence of the virus for the natural host. (See also W79-05435) (Chilton-ORNL)
W79-05470

EPIDEMIC PROBLEMS AND CHLORINATION OF DRINKING WATER AND SEWAGE IN THE FEDERAL REPUBLIC OF GERMANY,
Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden-, und Lufthygiene.
G. Muller.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 483-492. 1978. 3 fig, 8 ref.

Descriptors: *Chlorination, *Water pollution, *Public health, Epidemics, Water pollution effects,

Environmental effects, Human diseases, Epidemiology.

This paper reviews the history of epidemics transmitted through drinking water in Germany and discusses the advantages of disinfection through chlorination. Because of the association of bacterial disease and epidemics with the use of raw river water for drinking purposes, ground water from underground aquifers is used for drinking water production. Water treatment and supply technique are not uniform but vary depending upon the chemical and biological conditions of the raw water. Chlorination varies from town to town and from region to region. It is stated that drinking water disinfection by chlorination was a decisive factor in combating infectious waterborn epidemic outbreaks but that the advantage of chlorination may be partially offset by the potential health hazards of noninfectious agents. (See also W79-05435) (Chilton-ORNL)
W79-05471

WORLDWIDE ASPECTS OF WATER CHLORINATION,
World Health Organization, Geneva (Switzerland). Div. of Environmental Health.
L. A. Orihuela, R. C. Ballance, and R. Novick.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 493-507. 1978. 6 ref.

Descriptors: *Environmental effects, *Water pollution, Public health, Water quality, Chlorination, Water supply.

This paper reviews the use of disinfectants for drinking water on a worldwide basis and the present global water supply situation. It was concluded that the severe and pervasive deficiencies in water supply are beginning to receive attention commensurate to their importance at both national and international levels of government. The recommendations on community water supply of the United Nations Water Conferences are presented. (See also W79-05435) (Chilton-ORNL)
W79-05472

RISK ASSESSMENT OF THE HEALTH EFFECTS OF WATER CHLORINATION,
National Cancer Inst., Bethesda, MD.
M. Schneiderman.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 509-515, 1978. 1 fig, 8 ref.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Public health, Water quality, Human diseases.

This paper discusses the complexities of determining risk assessments related to health effects of water chlorination. The chemical interactions of chlorine with substances present in water are discussed. Quantitative relationships is identified as a major need of regulatory agencies. (See also W79-05435) (Chilton-ORNL)
W79-05473

CHLORINATION AND WATER TREATMENT FOR MINIMIZING TRIHALOMETHANES IN DRINKING WATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
R. C. Hoehn, C. W. Randall, R. P. Goode, and P. T. B. Shaffer.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, TN., p 519-535, 1978. 6 fig, 2 tab, 29 ref. EPA 68-01-3202.

Descriptors: *Chlorination, *Water chemistry, Environmental effects, Water quality, Water pollution.

The objectives were to show the effectiveness of powdered activated carbon (PAC) for reducing finished water trihalomethane (THM) concentrations when used in conjunction with routine water treatment (including chlorination) of a simulated surface water containing humic acids and to discuss experimental results. PAC of the type used in this study was found to be only minimally effective in reducing THM concentrations in finished waters. Coagulation with ferric sulfate, followed by flocculation and sedimentation, accounted for the majority of the reductions seen in THM concentrations. THM concentrations in finished water correlated directly with the extent of algae growth. It was recommended that the potential use of PAC for reducing organics should not be discounted on the basis of this study. Other THM precursors, intermediates in the haloform reaction, and hazardous organics may be effectively removed by PAC. Predisinfection is recommended when surface waters are contaminated by urban runoff and sewage discharges. (See also W79-05435) (Chilton-ORNL)
W79-05474

FORMATION AND OCCURRENCE OF HALOFORMS IN DRINKING WATER IN THE FEDERAL REPUBLIC OF GERMANY,
Bundesgesundheitsamt, Berlin (Germany, F. R.). Inst. fuer Wasser-, Boden-, und Lufthygiene.
M. Sonneborn, and B. Bohn.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p 537-542. 1978. 1 tab, 14 ref.

Descriptors: *Chlorination, *Water chemistry, Water pollution, Potable water, Water quality, Germany, Water quality standards.

An overview is presented of water quality and the ordinances regulating water quality in Germany. Laws stipulate that the consumption of drinking water must not result in any impairment to the consumer's health. Studies performed in 27 different cities revealed that only chloroform was present above 1 microg/l, while the concentrations of the remaining haloforms fell within the nanogram/l range. The highest chloroform concentration observed was up to 52 microg/l. It was suggested that the main reason for the lower haloform concentrations in drinking water in Germany compared to the higher values determined in the U.S. is the dosage of chlorine for disinfecting purposes. (See also W79-05435) (Chilton-ORNL)
W79-05475

OZONE, CHLORINE DIOXIDE AND CHLORAMINES AS ALTERNATIVES TO CHLORINE FOR DISINFECTION OF DRINKING WATER,
Municipal Environmental Research Lab., Cincinnati, OH. Water Supply Research Div.
J. M. Symons.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 555-560, 1978. 1 tab.

Descriptors: *Chlorination, *Water treatment, Organic compounds, Public health, Disinfection.

A brief discussion and summary of a report containing papers by several authors is presented here. The advantages and disadvantages of chlorine as well as of each of the suggested alternatives are considered. Four alternatives presented are chlorine dioxide, ozone plus chlorine dioxide or chloramines to maintain a residual, chlorine followed shortly by ammonia to stop trihalomethane formation reaction, and chlorine dosed at a concentration less than the chlorine demand followed by chlorine dioxide or chloramines to maintain a residual. Each of these options would reduce trihalomethane concentrations, would provide adequate initial disinfection and would provide a biocide in the distribution system. Limiting the dose of any disinfectant is also suggested. (See also W79-05435) (Chilton-ORNL)
W79-05477

EVALUATION OF THE CAPABILITY OF GRANULAR ACTIVATED CARBON AND RESINS TO REMOVE CHLORINATED AND OTHER TRACE ORGANICS FROM TREATED DRINKING WATER,
Drexel Univ., Philadelphia, PA. Dept. of Chemistry; and Drexel Univ., Philadelphia, PA. Environmental Studies Inst.
I. H. Suffet, J. V. Radziul, P. R. Cairo, and J. T. Coyle.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L. , Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee, p. 561-582, 1978. 6 fig, 3 tab, 12 ref.

Descriptors: *Water chemistry, *Analytical techniques, Chlorination, Water treatment, Disinfection.

This paper presents the analysis of trace organics in drinking water, and their removal by granular activated caron (GAC) and resins. It was concluded that GC profiles on packed columns can be utilized to successively screen primary profile changes. A peak on a packed column typically may contain three or more components and therefore analysis of subtle changes requires capillary GC. Pilot column studies showed that Filtrasorb-400 is a better adsorbent than XE-340 and that XE-340 is better than XAD-2. Performance evaluation of adsorbents was demonstrated by weekly GC profile monitoring of the organics in the influent and effluent stream of pilot columns. These profiles enabled the choice of selected samples for GC/MS identification when used in conjunction with pilot column studies. (See also W79-05435) (Chilton-ORNL)
W79-05478

TRIHALOMETHANE FORMATION FROM IODINE AND CHLORINE DISINFECTION OF OHIO RIVER WATER,
Cincinnati Univ., OH. Dept. of Civl and Environmental Engineering.
J. Rickabaugh, and R. N. Kinman.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p. 583-591, 1978. 5 tab, 12 ref.

Descriptors: *Water treatment, *Chlorination, Disinfection, Public health, Potable water, Water quality.

Elemental iodine and a mixture of monochloramine plus iodide ion were compared to chlorine, monochloramine and to a mixture of both chlorine and iodide ion by monitoring trihalomethane formation over a pH range of 7.5 to 9.0. Data showed that elemental iodine produced 67.8 to 99.5% lower concentration of total trihalomethanes (TTHM) than did chlorine. Monochloramine-iodide ion treatment at pH values 7.5 to 8.5 produced 92.2 to 98.9% lower levels TTHM than did chlorine. At pH 9, monochloramine-iodide ion treatment produced only 80 to 87% lower TTHM levels than chlorine. In general, monochloramine-iodide ion produced the lowest levels of trihalomethanes found during this study. (See also W79-05435) (Chilton-ORNL)
W79-05479

THE EFFECT OF PREOZONATION ON CHLOROFORM PRODUCTION IN THE CHLORINE DISINFECTION PROCESS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
T. L. Riley, K. H. Mancy, and E. A. Boettner.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H.

and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 593-603, 1978. 2 fig, 2 tab, 14 ref.

Descriptors: *Water treatment, *Chlorination, Ozone, Disinfection, Organic compounds, Public health, Environmental effects.

A study is described which compares chloroform production between model systems using ozonation-postchlorination treatment and a model system using chlorination only. The effect of preozonation on chloroform production was found to be extremely pH-dependent. If both ozonation and chlorination processes are performed in water systems below pH 8, prezonation is effective in reducing chloroform production. In water systems between pH 8 and 10, even high doses of ozone are relatively ineffective in reducing chloroform production. Either ozonation at low pH followed by chlorination at pH values above 10 or ozonation and chlorination at high pH may result in enhanced chloroform production. (See also W79-05435) (Chilton-ORNL)
W79-05480

TRIHALOMETHANE REDUCTION AT THE LOUISVILLE WATER COMPANY,
Louisville Water Co., KY.
S. A. Hubbs, J. S. Zogorski, D. A. Wilding, A. N. Arbuckle, and G. D. Allgeier.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H.,Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 605-611, 1978 2 fig, 7 ref.

Descriptors: *Chlorination, *Water treatment, Organic compounds, Environmental effects, Public health, Ammonia.

This paper reports a program designed to establish analytical procedures, determine the occurrence and variation of trihalomethanes (THMs) in Louisville Water Company process waters, investigate the parameters controlling THM formation and devise treatment schemes that would provide a product water in compliance with anticipated EPA standards. Results showed a strongly seasonal variation in THM formation but not in raw water THM potential. A 40 to 50% reduction in THMs leaving the plant resulted from movement of prechlorination from the raw water reservoir to the coagulation process. Ammoniation at the softening basins accomplished approximately 50% reduction in THMs compared to a nonammoniated system. Ammoniation at the clearwell resulted in a 12% reduction in THMs reaching the tap. Prior to chlorination changes, total THM levels were 0.65 microM/l. Movement of chlorination to the coagulation process results in a THM level of 0.45 microM/l. If ammoniation is used optimally the level is reduced to 0.25 microM/l. (See also W79-05435) (Chilton-ORNL)
W79-05481

GENERATION OF VOLATILE ORGANIC COMPOUNDS FROM NONVOLATILE PRECURSORS IN WATER BY TREATMENT WITH CHLORINE OR OZONE,
Colorado Univ., Boulder. Dept. of Chemistry.
R. E. Sievers, R. M. Barkley, G. A. Eiceman , L. P. Haack, and R. H. Shapiro.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H.,Jr., (Eds.). Proceedings of a Conference, October 31 - November 4, 1977, Gatlinburg, Tennessee. p 615-624, 1978 2 fig, 12 ref. EPA R804472010 & R803968020.

Descriptors: *Chlorination, *Ozone, Waste treatment, Water treatment, Organic compounds, Environmental effects, Public health.

The presence of toluene, styrene and xylenes formed by chlorine treatment is the drinking water of approximately 20 US cities is reported. The major products of ozonolysis of wastewater are identified as being aliphatic aldehydes and alkanes. In some samples, the concentration of toluene also was found to increase upon ozonolysis. The production of aliphatic compounds in ozonized wastewater and the enhanced level of toluene found in some samples indicate that appropriate conditions of ozone treatment and/or plant influent composition may result in production of aromatic species as well as aliphatic hydrocarbons. It is suggested that investigations should be directed to determination of possible precursors of these products. (See also W79-05435) (Chilton-ORNL)
W79-05482

A STUDY OF ALTERNATIVES TO CHLORINATION FOR DISINFECTION OF WASTEWATER,
Municipal Environmental Research Lab., Cincinnati, OH.
A. D. Venosa, and R. W. Ward.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H.,Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 625-628, 1978 1 ref.

Descriptors: *Chlorination, *Environmental effects, Toxicity, Ozone, Bromine, Disinfection, Water treatment.

This paper is a synopsis of a more complete report recently published by the EPA. The study was conducted to determine the comparative effectiveness of chlorine, bromine chloride and ozone as disinfectants and to determine any residual toxicity associated with the use of these agents as disinfectants or with chlorinated wastewater which had been dechlorinated with sulfur dioxide. In disinfection tests, malfunctions in BrCl and 03 dosing systems occurred with greater frequency than in chlorination and dechlorination systems. Chlorination produced a lethal residual toxicity effect on fathead which was eliminated by dechlorination with sulfur dioxide. Acute toxicity tests indicated that nondisinfected effluent was toxic to most species of fish tested. Ozonation coupled with filtration eliminated toxicity associated with the effluent. Salmonid fishes were more sensitive to chlorobrominated effluent than to any other effluent. Chlorinated effluent was the most toxic effluent tested. Dechlorination with sulfur dioxide reduced this toxicity to levels similar to nondisinfected effluent. (See also W79-05435) (Chilton-ORNL)
W79-05483

BROMINE CHLORIDE AS AN ALTERNATIVE WASTEWATER DISINFECTANT TO CHLORINE,
Virginia State Water Control Board, Virginia Beach. Tidewater Regional Office.
W. L. Woodfin, Jr., R. B. Taylor, and R. C. Hoehn.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L. Gorchev, H. and Hamilton, D. H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977. Gatlinburg, Tennessee. p 629-636, 1978. 3 tab, 9 ref.

Descriptors: *Chlorination, *Environmental effects, Bromine, Chlorides, Bacteria, Disinfection, Public health.

This study compares chlorine and bromine chloride as disinfectant in filter-sterilized sewage inoculated with Escherichia coli and Streptococcus faecalis and examines the disinfection potential of both compounds in secondary effluent which has received no additional treatment. Bromine chloride was found to be the superior disinfectant against both organisms in filter-sterilized sewage containing no suspended solids. At residual concentrations as low as 0.15 mg/l in the batch reactor, BrCl provided 100% kills of E. coli and S. faecalis. Bromine chloride and chlorine were found to be equally effective in disinfecting unfiltered secondary treated effluent. (See also W79-05435) (Chilton-ORNL)
W79-05484

A COMPARISON OF BROMINE CHLORIDE AND CHLORINE AS WASTEWATER DISINFECTANTS IN PILOT PLANT STUDIES,
Hampton Roads Sanitation District, Virginia Beach, VA.
N. E. LeBlanc, and J. M. McEuen.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 637-650, 1978. 6 fig, 4 tab, 17 ref.

Descriptors: *Chlorination, *Environmental effects, Water pollution, Water treatment, Bromine, Chlorides, Halogens, Pilot plants.

This paper describes pilot plant studies designed to evaluate the use of bromine chloride as a disinfectant at a 0.244 mgd disinfection pilot unit. Data gathered during the study indicate that bromine chloride and chlorine can both adequately disinfect wastewater in relation to current guidelines. The use of bromine chloride results in a significant decrease in the discharge of halogen residual. Further investigation into the technology for applying bromine chloride in large-scale applications is indicated. (See also W79-05435) (Chilton-ORNL)
W79-05485

CHLORINE DIOXIDE DESTRUCTION OF VIRUSES AND BACTERIA IN WATER,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
S. Cronier, P. V. Scarpino, and M. L. Zink.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 651-658, 197 p, 6 gih, 7 ref. EPA R-804418.

Descriptors: *Chlorination, *Water treatment, Water pollution, Disinfection, Potable water, Bacteria, Water quality, Viruses.

Studies on the inactivation and destruction of viruses and bacteria by chlorine dioxide in comparison to chlorine are reported. Poliovirus 1 and coxsackievirus A9 were compared with the bacterium Escherida coli. Results indicated that chlorine dioxide is an excellent disinfectant even when compared to chlorine. The test viruses were more resistant to disinfectants than E. coli. (See also W79-05435) (Chilton-ORNL)
W79-05486

CHLORINE AND ACTIVATED CARBON TREATMENT FOR REMOVAL OF TOXIC SUBSTANCES FROM WATER,
Jet Propulsion Lab., Pasadena, CA.
R. G. Howland, and C. J. Wallace.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H.,Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 659-674, 1978. 8 fig, 3 tab, 12 ref.

Descriptors: *Chlorination, *Water treatment, Water pollution, Toxicity, Activated carbon, Water quality.

Various treatments in which chlorination precedes treatment with activated carbon were evaluated. Results showed that the inherent dangers of chlorination are greatly reduced when a carbon - chlorine - carbon treatment is employed. Chlorination was found to enhance the removal of some compounds (phenol and aliphatic amines) over that accomplished by carbon alone. Evidence also indicated enhanced adsorptivity by activated carbon in the presence of various concentrations of chlorine. Analysis of hexane-extracted samples showed a positive advantage to the proposed treatment. Analysis of volatile low-molecular-weight halogenated hydrocarbons showed that the hazardous effect of chlorination is significantly decreased by the final carbon treatment. The final carbon treat-

ment results in a water which is low in free residual chlorine. (See also W79-05435) (Chilton-ORNL)
W79-05487

CHLORINE APPLICATION FOR THE CONTROL OF CONDENSER FOULING,
Department of Energy, Washington, DC. Div. of Biomedical and Environmental Research.
D. H. Hamilton, Jr.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 687-693, 1978, 3 tab, 7 ref.

Descriptors: *Chlorination, *Environmental effects, Cooling water, Research priorities.

This paper presents an overview of past and current usage of the practice of chlorination in the U.S. It is suggested that a downward trend in the use of chlorine exists but that rapid develop of new technology may reverse the trend. It was concluded that whatever the actual time course of the development of this technology and whatever the actual amounts of chlorine ultimately used, there appears to be justification for support of programs directed at resolution of the questions surrounding the hazardous effects of chlorination on the environment. (See also W79-05435) (Chilton-ORNL)
W79-05489

MEASUREMENT AND SIGNIFICANCE OF SPECIFIC ACTIVITY IN THE HETEROTROPHIC BACTERIA OF NATURAL WATERS,
Gordon Coll., Wenham, MA. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-05490

A KINETIC MODEL FOR PREDICTING THE COMPOSITION OF CHLORINATED WATER DISCHARGED FROM POWER PLANT COOLING SYSTEMS,
Oak Ridge National Lab., TN. Chemistry Div.
M. H. Lietzke.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 707-716, 1978, 1 fig, 2 tab, 5 ref.

Descriptors: *Chlorination, *Model studies, Nuclear powerplants, Cooling water, Discharge(Water).

The purpose of this paper was to present a validation of a model presented in a previous report (ORNL/NUREG-13) using analytical data supplied by Commonwealth Edison taken during operation of the Quad Cities Nuclear Station. Two examples are given which demonstrate that the model may be applied to either once-through cooling systems or to cooling systems involving cooling towers. (See also W79-05435) (Chilton-ORNL)
W79-05491

BIOFOULING CONTROL ALTERNATIVES TO CHLORINE FOR POWER PLANT COOLING WATER SYSTEMS: AN OVERVIEW,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
D. T. Burton, and L. H. Liden.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 717-734, 1978, 1 tab, 29 ref.

Descriptors: *Chlorination, *Water treatment, Cooling water, Water pollution, Discharge(Water), Powerplants, Environmental effects.

This paper presents a discussion of biofouling and its control by chlorine and of biofouling control alternatives to chlorine. Criteria for alternatives are identified as: (1) effective control; (2) environmental acceptability better than chlorine; (3) engineering feasibility; (4) use must not cause frequent shutdown of generating units; (5) economic feasibility. The various methods discussed include chemical antifoulants and nonchemical techniques (thermal, hydraulic, mechanical). (See also W79-05435) (Chilton-ORNL)
W79-05492

BROMINE CHLORIDE - AN ALTERNATIVE BIOFOULING CONTROL AGENT FOR COOLING WATER TREATMENT,
Martin Marietta Corp., Baltimore, MD.
L. H. Bongers, D. T. Burton, L. H. Liden, and T. P. O'Connor.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds.). Proceedings of a Conference, October 31- November 4, 1977, Gatlinburg, Tennessee. p 735-752, 1978. 5 fig, 2 tab, 26 ref.

Descriptors: *Environmental effects, *Chlorination, Cooling water, Water pollution, Control, Chlorine, Bromine, Chlorides, Temperature.

This report presents data on decay characteristics of bromine chloride in estuarine water and on its biofouling control effectiveness at continuous application of 0.5 ppm or less. Bromine chloride appeared to be a more effective biocide than an equal equivalent of chlorine when the ambient ammonia concentrations are higher than the applied biocide concentration and salinities are 5 to 7 ppt or less. When bromine concentrations are relatively high and ammonia concentrations relatively low, the use of bromine chloride would not be environmentally advantageous to the use of chlorine. Both bromine chloride and chlorine provided adequate biofouling control at ambient water temperatures of 25C or less when added to low-salinity cooling water at a continuous dosage of 0.5 ppm or less. Cooling water temperature appeared to be the most critical parameter in determining the biocide dosage required to control biofouling in a once-through cooling system. (See also W79-05435) (Chilton-ORNL)
W79-05493

EVALUATION OF ALTERNATIVE CHEMICAL TREATMENTS FOR BIOFOULING CONTROL IN ELECTRIC POWER FACILITIES,
Northwestern Univ., Evanston, IL. Dept. of Civil Engineering.
T. D. Waite, R. M. Jorden, and R. Kawaratani.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 753-771, 1978. 1 fig, 18 ref.

Descriptors: *Chlorination, *Environmental effects, Cooling water, Control, Alternative planning, Ozone, Bromine, Iodine, Electric power production.

This paper evaluates chemical alternatives to chlorine as a biofouling control agent with emphasis on information gaps concerning the various alternatives. It is pointed out that while several biocides (ozone, iodine, permangate, ferrate, bromine and chlorine dioxide) have been evaluated against suspended microorganisms, almost no data are available on their effectiveness against biological films. Information on aqueous chemistry is lacking for salt or brackish water systems. Information on environmental effects, including synergistic reactions with oxidizing biocides, of organic biocides/biostats is needed. Information is also needed from pilot-scale experiments. A summation of information which is available on selected alternative chemicals is presented in tabular form. (See also W79-05435) (Chilton-ORNL)
W79-05494

STATUS OF REGULATION DEVELOPMENT FOR COOLING WATER DISCHARGES FROM POWER PLANTS,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
J. Lum.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. No. 2, Jolley, R.L., Gorchev, H. and Hamilton, D.H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 823-829, 1978. 1 append.

Descriptors: *Chlorination, *Environmental effects, Electric power production, Cooling water, Regulation, Effluents.

Effluent Guidelines Division is currently reassessing effluent limitations guidelines for the steam electric power industry. This effort was necessitated by the settlement of four suits between EPA, NRDC, EDF and the Fourth Circuit Court of Appeals decision of July 16, 1976 and the legal requirements of PL 92-500. The Agency is studying the potential discharge of 129 compounds which are listed in the appendix to this paper and other pollutants from cooling water systems. (See also W79-05435) (Chilton-ORNL)
W79-05495

5D. Waste Treatment Processes

WASTEWATER TREATMENT WITH HUMIC ACID-FLY ASH MIXTURES,
Missouri Univ.-Columbia. Dept. of Chemistry.
J. B. Green, and S. E. Manahan.
In: Chemistry of Wastewater Technology, Alan J. Rubin, Ed., Ann Arbor Science Publishers, Inc. Ann Arbor, Mich., 1978. p. 373-402 3 fig, 9 tab, 86 ref (1978). OWRT B-115-MO (3), USDI-OWRT 14-34-0001-6095.

Descriptors: Coal, *Humic acid, *Fly ash, Heavy metals, Acids, Organic matter, Suspended matter.

This chapter discusses the potential of humic acid and fly ash for the treatment of wastewater. Fly ash is inorganic matter produced by coal combustion, whereas humic acid is an integral part of the organic portion of low-rank coals and can be produced by the partial oxidation of higher-rank coals. Since both of these materials are obtained from coal, they have an especially high potential for the treatment of wastewater from coal utilization facilities. Neither have been used for water treatment on an industrial scale, although the effectiveness of both has been demonstrated in the laboratory. The properties of fly ash, coal humic acid, and mixtures of the two materials useful for wastewater treatment are discussed.
W79-05006

NEW DESIGN CRITERIA FOR THE AEROBIC DIGESTION OF SEWAGE LIME SLUDGE,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
Ju-Chang Huang, and Kuo-Chun Tsai.
Progress in Water Technology, Vol. 10, No. 1/2, p 615-631. 1978. OWRT A-074-MO(2), 14-31-0001, 5025, 6026.

Descriptors: *Aerobic digestion, Chemical sludge, Design parameters, *Lime, Operational control, Phosphorus precipitation, Primary sludge.

This study was undertaken to establish a set of design and operation criteria for the aerobic digestion of sewage lime sludge which was produced from phopshate precipitation in primary clarifiers. The aerobic digestion study was carried out at 20C. Special emphasis was placed on the evaluation of various parameters pertinent to the optimum process design and operational control for such a digester. The minimum solids detention time required in the digester is about 10 days. The air requirement for the digester is 60 scfm/1000 cu ft of digester volume. Following digestion, the VSS reduction is no more than 15 to 20 per cent, which is equivalent to only 2 to 4 per cent of the total sludge solids originally present in the raw lime sludge. However, the digested sludge is readily settleable for easy decantation and thickening. The sludge is also readily dewaterable by either drying beds or mechanical means. The dewatered sludge is suitable for ultimate disposal on land without creating any odor nuisance. The digested sludge supernatant and filtrate are low in P and COD.

their values being less than one half of those commonly found in domestic sewage.
W79-05009

LAND APPLICATION OF WASTE--IMPORTANT ALTERNATIVE,
Sheaffer and Roland, Inc., Chicago, IL.
For primary bibliographic entry see Field 5E.
W79-05032

LAND APPLICATION OF WASTE--STATE OF THE ART,
Wright-McLaughlin Engineers, Denver, CO.
For primary bibliographic entry see Field 5E.
W79-05033

NITRIFICATION WITH ROTATING BIOLOGICAL CONTACTOR SYSTEMS,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
F. M. Saunders, and R. L. Pope.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 290, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report No. ERC 06-78, October 1978. 85 p, 26 fig, 11 tab. OWRT A-058-GA(4). 14-31-0001-5010.

Descriptors: *Nitrification, *Waste water treatment, *Nitrifying bacteria, Nitrosomonas, Nitrobacter.

A laboratory bench-scale rotating biological contactor (RBC) system was utilized to evaluate the effect of microbial growth rates, expressed as cell residence time (theta sub c), on biological nitrification of a simulated secondary wastewater effluent. The effect of influent organic-nitrogen was examined as well as the effect of influent wastewater organic strength at a value of theta sub c near that for washout of nitrifying microorganisms. Theta sub c values were controlled by continuous circulation of RBC mixed liquor to remove sloughed biomass from suspension and by periodic scraping of attached biomass from disc surfaces. Kinetic relationships developed for the nitrifying microorganisms in the RBC system were in agreement with those developed for pure cultures of Nitrosomonas and Nitrobacter as well as nitrification data for mixed cultures in suspended growth biological wastewater treatment systems. The critical theta sub c value for washout of nitrifying microorganisms was approximately 1.5d. The hydrolysis of organically-bound nitrogen was not a rate-limiting step in nitrification. Organic loadings as high as 13.7 gCOD/m2.d had no effect on nitrification at nitrogen and hydraulic loading rates of 1.4 gN/m2.d and 70 l/m2.d, respectively. The results indicate that RBC systems can be effectively utilized for nitrification of domestic wastewaters with and without prior biological treatment. Further research should be conducted on pilot- and full-scale systems to determine the appropriate scale-up parameters.
W79-05047

MICROBIAL DEGRADATION OF DYE WASTES IN AQUEOUS EFFLUENTS,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
G. B. Michaels, and E. H. White.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 219, Price codes: A03 in paper copy, A01 in microfiche. Technical completion Report No. ERC 08-78, December 1978. 23 p, 4 tab. OWRT A-075-GA(1). 14-34-0001-8011.

Descriptors: *Dyes, *Microbial degradation, Biological treatment, Textiles, *Textile mill effluents, Sulfur dyes, Naphthol dyes.

Development of improved wastewater treatment facilities to reduce color and COD in dye-containing effluents is a problem of serious concern for both the textile and carpet industries. Existing biological treatment facilities reduce BOD to acceptable levels but are generally unsuccessful in reducing COD and color. Although previous studies have indicated that microbial populations would not significantly reduce the color of commercial dyes in dyehouse effluents, these studies sampled only the treatment facilities of the mills as a source of organisms which might have decolorizing potential. A wide variety of environmental sources were sampled for populations which could grow in dyebath solutions and decolor the dyestuffs. Carpet mill samples consisting of disperse dyes, acid dyes and disperse-acid mixtures were recalcitrant to microbial degradation. Textile dyes, however, could be decolored by microbial populations. Of the textile dye samples analyzed, 70% showed significant reduction. These suggest that microbial populations might be successfully incorporated into the design of treatment facilities for dye-containing effluents.
W79-05048

LAND APPLICATION OF WASTE--AN ACCIDENT WAITING TO HAPPEN,
Pirnie (Malcolm) Inc., Silver Spring, MD.
For primary bibliographic entry see Field 5B.
W79-05126

THE FEDERAL GROUND-WATER PROTECTION PROGRAM--TOMORROW'S UNDOING,
Wehran Engineering Corp., Middletown, NY.
For primary bibliographic entry see Field 5G.
W79-05129

ALGAE AND WATER POLLUTION,
For primary bibliographic entry see Field 5C.
W79-05322

PROCESS FOR PHOSPHATE CONVERSION COATING WITH TREATMENT OF RINSE WATER BY REVERSE OSMOSIS AND ION EXCHANGE,
Nippon Paint Co. Ltd., Osaka (Japan). (Assignee).
R. Murakami, and M. Zinnouti.
U.S. Patent No. 4,130,446, 7 p, 2 fig, 4 tab, 4 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 3, p 856, December 19, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Industrial water, *Water reuse, Reverse osmosis, Ion exchange, Recycling.

A process for phosphating a substrate of iron or steel comprises treating the substrate with a phosphating solution containing phosphate ions, zinc ions and, as an accelerator, at least one member selected from the group consisting of nitrite ions, chlorate ions and bromate ions, and rinsing the thus treated substrate with water in multiple steps. A part of the rinsing water containing the phosphating solution rinsed from the surface of the substrate is passed through a reverse osmosis membrane to form a concentrate and a filtrate. The concentrate is recycled for use in the phosphating solution, and filtrate is treated with ion-exchange resins of the H-type and the OH-type to remove undesirable ions and the thus treated filtrate is then recycled for use in the rinsing water. (Sinha-OEIS)
W79-05372

LIQUID TREATMENT PROCESS,
M. E. Garrett, and R. M. Keene.
U.S. Patent No. 4,129,502, 5 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 2, p. 538, December 12, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Gases, Bubbles, Dissolved oxygen, Hydrogen ion concentration, Neutralization, Equipment.

A process for treating liquid by dissolving an oxygen rich gas in the water, for example waste water having a biochemical demand, comprises passing the liquid into a container, passing a stream of the liquid under pressure through a conduit, introducing gas into the stream to form bubbles of gas in the liquid, and passing the stream of liquid and gas bubbles downwardly through an expansion chamber in which the velocity of the liquid stream is reduced to a value which allows a prolonged contact time between the gas and liquid while allowing the larger bubbles of gas to rise in the chamber. The stream is introduced into the chamber so as to create sufficient turbulence within the chamber to shatter some of the larger bubbles in the stream into relatively smaller bubbles. The stream containing liquid, dissolved gas and possibly relatively small bubbles of undissolved gas is passed into a lower settling zone of the container, and the pH of the liquid is controlled to a value in a predetermined range, e.g. by stripping unwanted gases, such as carbon dioxide, and/or by the addition of buffering or neutralizing chemicals. The invention also provides apparatus for treating the liquid. (Sinha-OEIS)
W79-05377

METHOD AND APPARATUS FOR SEPARATING SOLIDS FROM LIQUIDS,
Ecodyne Corp., Lincolnshire, IL. (Assignee).
J. A. Bell, R. B. Higgins, D. G. Mason, and J. C. Weaver.
U.S. Patent No. 4,127,488, 5 p, 4 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 4, p 1255, November 28, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Separation techniques, Water clarification, Flow rates, Flow control, Gravity separation.

A method and apparatus is provided for clarifying sewage fed in through centrally discharging peripheral downcomers that are readily adjustable to accomodate changing flow rates and process conditions. The clarification device for solids-liquid separation by gravitational settling has a peripheral inlet trough connected to uniformly spaced inlet conduits which direct influent liquid and solids toward the center of the clarifier. The size of the hole in the inlet trough can be selectively controlled and individually changed. This enables the volume of liquid and solids withdrawn through each hole to be controlled so as to cause the velocity energy decrease at each hole to generally equal the friction energy loss between any hole and the preceding hole while maintaining about the same volume of discharge flow. (Sinha-OEIS)
W79-05381

METHOD OF CLARIFYING AND REMOVING WATER FROM WATER-SOLIDS SUSPENSIONS,
Haliburton Co., Duncan, OK. (Assignee).
J. L. Watson, and P. L. Totten.
U.S. Patent No. 4,127,482, 5 p, 2 tab, 7 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 4, p. 1253, November 28, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water purification, *Suspended solids, Separation techniques, Flocculation, Screens, Drilling fluids.

The method for clarifying and removing water from a sump or pit containing a water-solids suspension such as spent aqueous drilling fluids comprises of dispersing at least one or more of a particular class of a solids flocculating additive into the suspension in an amount sufficient to form flocculent masses of a particular size. Then the water is withdrawn from the sump through a screen of a size which prevents the flocculent masses from pass through and clarified water is continuously removed. A particularly suitable nonionic polyacrylamide flocculating agent for flocculating suspended solids commonly found in drilling fluids is comprised of a mixture of polyacrylamide, a small amount of an ester of a fatty acid and a small amount of a surface active agent which increases the solubility of the polyacrylamide. (Sinha-OEIS)
W79-05383

TREATMENT OF EFFLUENTS,
Matthey Rustenburg Refiners (Pty) Ltd., Johannesburg (South Africa). (Assignee).

J. J. MacGregor.
U.S. Patent No. 4,127,458, 3 p, 6 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 4, p. 1246, November 28, 1978.

Descriptors: *Patents, *Industrial wastes, *Waste water treatment, *Metals, *Separation techniques, Electrolysis, Electrochemistry, Hydrogen ion concentration, Temperature, Chemical precipitation, Metal recovery, Anodic oxidation, Metal refining, Platinum.

A process for recovering platinum group metal present as a stable complex dissolved in an aqueous effluent from a platinum group metals refinery comprises: (1) adjusting the pH of the effluent as necessary to an alkaline pH of at least 10; (2) heating the effluent to a temperature above 60C; (3) electrolyzing the effluent using an electrode comprising at least one metal selected from the group consisting of Ru, Rh, Pd, Ir, Pt and alloys at an anode potential having a half-cell voltage of at least 7.5 volts and a current density of at least 0.2A/sq cm so as to break down the complex by anodic oxidation and precipitate metal present in the complex; and (4) filtering off the precipitated metal. (Sinha-OEIS)
W79-05385

PROCESS FOR PURIFYING WASTE WATER OBTAINED BY A PAPERMAKING PROCESS,
Liia Edet Aktiebolag (Sweden). (Assignee).
L. O. Barkman.
U.S. Patent No. 4,127,440, 5 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 976, No. 4, p 1240, November 28, 1978.

Descriptors: *Patents, *Waste water treatment, *Pulp wastes, *Water purification, *Water quality control, Water pollution treatment, Pulp and paper industry, Fibers(Plant), Separation techniques.

The waste water obtained from a papermaking process is purified to remove the last traces of fibers suspended in the water by mixing the waste water with those contaminating materials that are separated from the paper pulp suspension before it is fed to the papermaking machine. These contaminants act as a filter aid and make it possible to separate the fibers remaining in the water phase after the water from the papermaking machine has been subjected to a flocculating process, filtering and screening. The great advantage of the process is that valuable fibers are recovered without there being any need to add costly filter aid which would lead to an increase in the volume of the final waste material. (Sinha-OEIS)
W79-05386

PRIMARY EFFLUENT TREATMENT AT (CONSOLIDATED-BATHURST LTD.) PONTIAC (DIVISION, QUEBEC),
Consolidated-Bathurst Ltd., Portage du Fort (Quebec).
E. B. Cannell.
Canadian Pulp and Paper Association Technical Section, Environment Improvement Conference, October 17-19, 1978, Thunder Bay, Ontario, Preprints, p L1-L2. Canadian Pulp and Paper Association, Montreal.

Descriptors: *Pulp wastes, *Waste water treatment, Pollution abatement, Treatment facilities, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Canada, Foreign countries, Pulp and paper industry, Effluents, Suspended solids, Screens, Sludge treatment, Sludge, Dewatering, Bark, Clarifiers, Wood rooms(Paper mill).

The primary effluent treatment system at Consolidated-Bathurst Ltd.'s kraft pulp mill consists of a traveling screen for removal of particles larger than 2.2 cm in diameter, a clarifier (47 m in diameter) for suspended solids removal, and six water extractors for sludge dewatering. Approximately 25 metric tons of suspended solids enters the system every day. Clarifier overloads and downtime necessitate by-passing of the clarifier for 20% of the time. When the clarifier and extractors are operating, a 65% suspended solids reduction is achieved. The problem of suspended solids overload at the clarifier has been partially solved by conversion to dry barking, the removal of bark from woodroom effluent, and the installation of a knotter and a second lime mud washer. (Swichtenberg-IPC)
W79-05416

PROBLEMS ASSOCIATED WITH AN AERATED LAGOON,
Ontario-Minnesota Pulp and Paper Co. Ltd., Fort Frances, (Ontario).
W. R. Bennett.
Canadian Pulp and Paper Association Technical Section, Environment Improvement Conference, October 17-19, 1978, Thunder Bay, Ontario, Preprints, p M1-M2. 1 fig. Canadian Pulp and Paper Association, Montreal.

Descriptors: *Pulp wastes, *Waste water treatment, *Aerated lagoons, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Biochemical oxygen demand, Canada, Foreign countries, Pulp and paper industry, Effluents, Lagoons, Aeration, Hydrogen ion concentration, Foaming, Winter, Operating problems, Aerators, Kraft mills.

The aeration lagoon at the Ontario-Minnesota Pulp and Paper Co. Ltd., Fort Frances, Ontario, began operation in conjunction with the startup of a bleached kraft pulp mill in November 1971. The lagoon is J-shaped, approximately 3100 ft long, 430 ft wide, and 12 ft deep and has a design retention time of 5 days. Aeration if provided by nine 75 hp low-speed floating aerators. The present BOD loading is approximately 60,000 lb/day, of which 22,000 lb/day originate in paper mill wastes. The efficiency of the system is low since the aerators can reduce only about 32,000 lb of BOD/day. This situation will be alleviated with the startup of a new clarifier and paper mill in-plant fiber recovery system. Problems experienced at the lagoon included pH and other shocks, windblown foam, capsizing of the floating aerators during the winter, and excessive BOD loading after it was decided to treat specialty-paper mill effluents in addition to kraft mill effluents. (Swichtenberg-IPC)
W79-05417

PRIMARY EFFLUENT TREATMENT AT DOMTAR (FINE PAPERS LTD.) CORNWALL MILL,
Domtar Fine Papers, Cornwall (Ontario).
I. W. A. Snider.
Canadian Pulp and Paper Association Technical Section, Environment Improvement Conference, October 17-19, 1978, Thunder Bay, Ontario, Preprints, p K1-K5. 5 fig. Canadian Pulp and Paper Association, Montreal.

Descriptors: *Pulp wastes, *Waste water treatment, *Treatment facilities, Canada, Pulp and paper industry, Effluents, Wastes, Industrial wastes, Water pollution treatment, Waste treatment, Water pollution sources, Foreign countries, Sludge, Sludge treatment, Dewatering, Suspended solids, Water pollution control, Filters, Clarifiers, Fiber recovery, Black liquor, Spills.

The primary effluent treatment facility at Domtar Fine Papers Ltd. (Canada) consists of a 386 ft (118 m) long diffuser with a grit chamber, a 250 ft (76 m) diameter clarifier, sludge removal and dewatering equipment, and a screen/centricleaner system for removal of fiber from the sludge. The system can handle an effluent flow of 60,000,000 imperial gal/day (273,000 cu m/day). Poor suspended solids removal by the clarifier was alleviated by in-plant measures, namely, a black liquor spill collection system, startup of a belt filter for removal of the green liquor dregs, and conversion to dry barking. (Swichtenberg-IPC)
W79-05418

EFFLUENT TREATMENT AT PRINCE GEORGE PULP AND PAPER LTD.,
Prince George Pulp and Paper Ltd. (British Columbia).
J. McDonald.
Canadian Pulp and Paper Association Technical Section, Environment Improvement Conference, October 17-19, 1978. Thunder Bay, Ontario, Preprints, p I1-I9. 7 fig, 4 tab. Canadian Pulp and Paper Association, Montreal.

Descriptors: *Pulp wastes, *Waste water treatment, *Treatment facilities, Water pollution treatment, Water pollution sources, Wastes, Industrial wastes, Waste treatment, Pulp and paper industry, Effluents, Canada, Foreign countries, Biochemical oxygen demand, Aeration, Aerated lagoons, Activated sludge, Lagoons, Bleaching wastes, Toxicity, Clarifiers, Kraft mills.

Primary clarifiers were installed to handle the fiber-containing kraft mill effluents at the treatment facilities of Prince George Pulp and Paper Ltd. and Intercontinental Pulp Co. Ltd. of Canada. To improve BOD removal, an aeration stabilization basin (ASB) with a 245,000,000 gal capacity and a 4.3-day retention time was constructed at Prince George to receive the effluent from the primary clarifiers and low-rate activated sludge lagoons (which process bleach plant effluents and toxic spills) of both kraft mills. Design parameters and problems with the basin are discussed, including reasons for using subsurface aeration. An effluent flowsheet and performance data for the ASB are also included. (Swichtenberg-IPC)
W79-05419

THE GROWTH PATTERNS OF SOME ENTERIC BACTERIA IN A KRAFT PULP MILL/DOMESTIC SEWAGE COMBINED TREATMENT SYSTEM,
Environmental Protection Service, Edmonton(Alberta).
J. B. Bell, W. Macrae, J. F. J. Zaal, and J. M. Vanderpost.
Canadian Pulp and Paper Association Technical Section, Environment Improvement Conference, October 17-19, 1978, Thunder Bay, Ontario, Preprints, p. H1-H13. 7 fig, 26 ref, 5 tab. Canadian Pulp and Paper Association, Montreal.

Descriptors: *Pulp wastes, *Municipal wastes, *Waste water treatment, *Bacteria, Water pollution sources, Wastes, Industrial wastes, Salmonella, Enteric bacteria, Microorganisms, Sewage bacteria, Coliforms, Aquatic microorganisms, Aquatic bacteria, Pulp and paper industry, Aeration, Waste treatment, Water pollution treatment, Klebsiella, Effluents.

Laboratory fermenter and field studies conducted by Environment Canada indicate that Salmonella paratyphi B cannot compete with normal flora during aeration of combined kraft pulp mill/municipal effluents at temperatures above 20C. Survival for more than 14 days occurred at temperatures of 4-10C. Salmonella paratyphi B survived for prolonged periods in domestic sewage at 30C even with aeration. The correlation coefficient for Salmonella and coliforms survival under similar situations was 0.7989, indicating that coliform growth patterns in this type of effluent mixture may be used to predict Salmonella growth patterns. Coliforms and fecal coliforms were reduced by 99.87 and 99.66%, respectively, in the combined effluent treatment system. More than 50% of the coliforms and fecal coliforms discharged by the combined treatment system were Klebsiella. (Swichtenberg-IPC)
W79-05420

EFFECT OF PROCESS WATER RECYCLE ON POLLUTION CONTROL AND ENERGY CONSERVATION,
Consolidated-Bathurst Ltd., Montreal (Quebec).
For primary bibliographic entry see Field 3E.
W79-05422

DEVELOPMENT OF A PRACTICAL METHOD TO REDUCE THE TOXICITY OF KRAFT MILL EFFLUENTS BY RETAINING SOME OF THE TOXIC MATERIALS WITH THE PULP.

Econotech Services Ltd., Ottawa (Ontario).
Canadian Environmental Protection Service, Ottawa, Ontario K1A 1C8. Cooperative Pollution Abatement Research (CPAR) Project Report 617-1, Final Report to March 31, 1977, 58 p. 1 fig, 9 ref, 16 tab. CPAR 617-1

Descriptors: *Pulp wastes, *Toxicity, *Bleaching wastes, *Water pollution control, Wastes, Industrial wastes, Water pollution sources, Hydrogen ion concentration, Adsorption, Chlorination, Pulp and paper industry, Effluents, Surfactants, Black liquor, Resin acids, Kraft pulp, Talc, Pollution abatement.

The adsorption of resin acids and other toxicants on kraft pulp from black liquor and spent bleaching liquors was studied using laboratory and mill pulps and liquors. The major factor in adsorption was found to be the solution pH; the adsorption increased as the pH was decreased from 11 to 2. The addition of talc increased the adsorption of resin acids from alkaline solutions; surfactants decreased the adsorption. The toxicity of dilute black liquor or bleaching effluents (caustic extraction stage effluents) was decreased by the adsorption of resin acids and other toxicants on pulp. Chlorination decreased the toxicity of resin acids, and alkaline treatment of the chlorination-stage effluent decreased the toxicity substantially. Methods to decrease mill effluent toxicity by adsorption or desorption of toxicants are discussed. (Witt-IPC)
W79-05424

USE OF THE ACTIVATED SLUDGE PROCESS IN THE TREATMENT OF THERMOMECHANICAL PULPING EFFLUENTS,
Australian Newsprint Mills Ltd.
D. S. Thurley, and D. E. Richardson.
Appita, Vol. 32, No. 2, p 103-108, September, 1978. 6 fig, 14 ref, 3 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Activated sludge, Detoxification, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Pulp and paper industry, Effluents, Biological treatment, Foreign countries, Pine trees, Pinus radiata, Biochemical oxygen demand, Suspended solids, Color, Bioassay, Aquatic microorganisms, Toxicity, Pilot plants, Australia, Thermomechanical pulping, Newsprint mills.

Pilot-scale investigations were carried out to determine the suitability of activated sludge treatment of thermomechanical pulping effluents. Pulp is produced from Pinus radiata chips in a Bauer double-disk refiner, diluted to approximately 5% stock consistency to simulate water usage in a newsprint mill, filtered, and the filtrate is used as feed to the secondary effluent treatment pilot plant. The average 5-day BOD of the feed is 770 mg/liter while the effluent from the plant has an average 5-day BOD of 10 mg/liter, suspended solids of 17 mg/liter, and a color of less than 120 Hazen units. Bioassays, using a variety of aquatic organisms, have shown that the activated sludge successfully removes the toxic components from the pulping wastes. (Swichtenberg-IPC)
W79-05425

CONTROL OF ACTIVATED SLUDGE BULKING DURING BIOLOGICAL PURIFICATION (REGULIROVANIE PRIROSTA AKTIVNOGO ILA PRI BIOLOGICHESKOI OCHISTKE),
GIPROBUM (USSR).
M. A. Evilevich, and L. K. Korovin.
Bumazhnaya Promyshlennost', No. 8, p 27-28, August, 1978. 3 fig, 1 tab.

Descriptors: *Activated sludge, *Waste water treatment, *Control, Organic loading, Water pollution treatment, Water quality control, Wastes, Waste treatment, Water pollution sources, Biological treatment, Sludge, Equations, Suspended solids, Aeration, Water purification, Solid wastes, Mass balance.

Biological purification of effluents is accompanied by changes (Bulking) in the mass of the activated sludge. A condition for the stability of the purification process is the maintenance of a strict balance between the discharge of excess sludge and its increment. An analysis was made of the activated sludge process, and a mass balance equation was obtained expressing the discharge of activated sludge from the system (tons/day) as a function of the total amount of suspended solids entering the aeration tanks (tons/day), amount of organic impurities removed in the tanks (tons of 5-day BOD/day), and a parameter, named activated sludge increment coefficient, representing the product of the economic increment coefficient (ratio of biomass concentration to the concentration of the substrate) and a dimensionless function (derived from the process variables). The correctness of the relation was confinmed by experimental data. The sludge increment coefficient depends on the quality of the suspension entering the aeration tanks and the activated sludge load. The activity in the system is controlled by varying the amount of sludge discharged, to maintain the stability of the purification process. (Stapinski-IPC)
W79-05431

SOLUBLE ORGANIC CONSTITUENTS OF NATURAL WATERS AND WASTEWATERS BEFORE AND AFTER CHLORINATION,
North Texas State Univ., Denton. Inst. of Applied Sciences; and North Texas State Univ., Denton. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W79-05436

THE EFFECT OF PREOZONATION ON CHLOROFORM PRODUCTION IN THE CHLORINE DISINFECTION PROCESS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
For primary bibliographic entry see Field 5C.
W79-05480

TRIHALOMETHANE REDUCTION AT THE LOUISVILLE WATER COMPANY,
Louisville Water Co., KY.
For primary bibliographic entry see Field 5C.
W79-05481

GENERATION OF VOLATILE ORGANIC COMPOUNDS FROM NONVOLATILE PRECURSORS IN WATER BY TREATMENT WITH CHLORINE OR OZONE,
Colorado Univ., Boulder. Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W79-05482

ULTRAVIOLET DISINFECTION OF MUNICIPAL EFFLUENTS,
Municipal Environmental Research Lab., Cincinnati, OH.
A. D. Venosa, H. W. Wolf, and A. C. Petrasek.
In: Water Chlorination: Environmental Impact and Health Effects, Vol. 2, Jolley, R. L., Gorchev, H. and Hamilton, D. H., Jr., (Eds.). Proceedings of a Conference, October 31-November 4, 1977, Gatlinburg, Tennessee. p 675-684, 1978, 2 tab, 1 ref.

Descriptors: *Water treatment, *Ultraviolet radiation, Disinfection, Water quality, Dallas, Design.

The advantages and disadvantages of irradiation with ultraviolet light as a method of disinfection of water is discussed. A case, The Dallas Study, is reported with emphasis on the relationship between dosage and disinfection. It was suggested that, since the applied dosage of UV light is directly related to the quality of water being treated and to the log reduction in microbial numbers, more intensive effort is needed to develop accurate means of measuring dosage in UV exposure chambers. Further investigation is also indicated on the occurrence and prevention of film buildup on quartz sleeves and viewing windows. Chemical vs mechanical cleaning procedures should be compared for long-term effectiveness. (See also W79-05435) (Chilton-ORNL)
W79-05488

BLEACH PLANT OPERATION,
Erco Envirotech Ltd., London (England).
For primary bibliographic entry see Field 3E.
W79-05497

5E. Ultimate Disposal Of Wastes

EFFECTS OF SLUDGE APPLICATIONS ON SOIL WATER SOLUTION AND VEGETATION IN A NORTHERN HARDWOOD STAND,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
M. T. Koterba, J. W. Hornbeck, and R. S. Pierce.
Journal of Environmental Quality, Vol. 8, No. 1, p 72-78, January-March, 1979. 6 fig, 4 tab, 30 ref. OWRT A-039-NH(4), 14-31-0001-4029.

Descriptors: Forest management, *Sludge, Nutrients, *Leaching, Microbial degradation, Sludge treatment, Forest soils, Recycling, Biodegradation, Cations, Anions, Growth rates, Plant growth, *Land application, Soil water.

Dewatered and limed sludge from a primary treatment plant was applied at two rates, 25 and 125 wet metric tons/ha (5.8 and 28.0 dry metric tons/ha), on sandy loam soils in a northern hardwood forest in central New England. Changes in soil water solution were assessed from water samples collected with suction lysimeters at 20- and 45-cm depths below the mineral surface. The light application of 25 metric/ha had little effect, but the heavy application of 125 metric/ha caused an increase in the concentration of most ions in soil water. The concentrations of most ions returned to background levels within 1 year after sludge application. There were no sigiciant differences in basal-area growth among control and treated plots for the first two growing seasons after sludge application. In the herb and shrub layer only 3 of the 31 commonly occurring species showed statistically significant changes in frequency. All three changes were on plots receiving the heavy application.
W79-05002

LAND APPLICATION OF WASTE--IMPORTANT ALTERNATIVE,
Sheaffer and Roland, Inc., Chicago, IL.
J. R. Sheaffer.
Ground Water, Vol. 17, No. 1, p 62-68, January-February 1979. 1 fig, 3 tab, 8 ref.

Descriptors: *Waste water disposal, *Waste water treatment, *Sewage effluent, Irrigation, Agriculture, Land management, Soils, Nutrients, Chemicals, Sewage treatment, Pollutants, Groundwater, *Land application, Land treatment.

Land treatment uses a combination of processes to manage and beneficially use wastewater. The treatment represents a revolution in sewage treatment because it: (1) transforms sewage treatment from a single purpose activity into a multipurpose activity, (2) changes sewage treatment construction grants from subsidies into investments in the production of food and fiber, and (3) requires the participation of a variety of disciplines to implement successfully. Because it is revolutionary to the sewage treatment field, three situations have developed. First, it is displacing traditional technology at a record-breaking pace. Second, its logical appeal to thinking decision makers has created a situation in which the policy makers are ahead of many technicians. Third, it is attacked with a fervor heretofore unknown in the sewage treatment field. Land treatment has logged an enviable track record in the United States. Existing systems have produced a high quality effluent at economically competitive prices. In addition, in terms of relative risk, the threat to environmental quality from a land treatment system compares favorably with advanced waste treatment systems. (Sims-ISWS)
W79-05032

LAND APPLICATION OF WASTE--STATE OF THE ART,
Wright-McLaughlin Engineers, Denver, CO.

K. R. Wright, and C. K. Rovey.
Ground Water, Vol. 17, No. 1, p 47-61, January-February 1979. 2 fig, 9 tab, 18 ref.

Descriptors: *Waste water disposal, *Waste water treatment, *Sewage effluents, Sewage sludge, Irrigation, Agriculture, Land management, Pastures, Crops, Groundwater, Soils, Nutrients, Nitrogen, Phosphorus, Monitoring, Reviews, *Land application, Land treatment.

Land application of treated wastewater can provide unique opportunities, not only for a final high level of wastewater treatment but also for reuse of nutrients. Recent laws passed by Congress have made it necessary to consider land treatment when planning and designing new wastewater treatment facilities. The three types of land treatment commonly used are irrigation, overland flow, and rapid infiltration. Selection of the most appropriate type of land treatment for a specific site is based on several considerations, including soil conditions, geology, topography, proximity to surface and subsurface water, and climate. Ensuring the protection of groundwater is essential when siting or designing a land treatment system. Groundwater is an important natural resource, having considerable impact on human life and well-being as well as high economic value. Safeguarding this important resource from contamination includes careful site selection, appropriate pretreatment of wastewater prior to its application, and a program of regularly scheduled monitoring to ensure that the wastewater is being properly renovated for safe release to the environment. Utilization of municipal sludge on land for agricultural production is encouraged by federal law, as is land treatment of wastewater. Sludge contains concentrated wastes, and there are practical limitations on the levels of heavy metals, salts, and toxic substances in sludges applied to agricultural lands. Sludge is generally stabilized before being applied to destroy pathogens and to reduce weight, volume, and odor. (Sims-ISWS)
W79-05033

SURFACE RUNOFF FROM SLUDGE-AMENDED SOILS,
Purdue Univ. Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W79-05041

LAND APPLICATION OF WASTE--AN ACCIDENT WAITING TO HAPPEN,
Pirnie (Malcolm) Inc., Silver Spring, MD.
For primary bibliographic entry see Field 5B.
W79-05126

APPLICATION OF PHASED COOLING TO A ONCE-THROUGH COOLING SYSTEM,
Auburn Univ., AL. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 5B.
W79-05227

SLUDGE TO LAND--ECONOMIC CONSIDERATIONS FOR WATER AUTHORITIES,
Water Research Center, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 6B.
W79-05320

A WATER DEMAND AND WASTEWATER DISPOSAL MODEL FOR OPTIMUM TRANSFER OF WATER RESOURCES TECHNOLOGY IN DEVELOPING COUNTRIES,
Federal Univ. of Paraiba, Campina Grande (Brazil). Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W79-05413

5F. Water Treatment and Quality Alteration

LAND APPLICATION OF WASTE--IMPORTANT ALTERNATIVE,
Sheaffer and Roland, Inc., Chicago, IL.
For primary bibliographic entry see Field 5E.
W79-05032

LAND APPLICATION OF WASTE--STATE OF THE ART,
Wright-McLaughlin Engineers, Denver, CO.
For primary bibliographic entry see Field 5E.
W79-05033

FATE OF METAL IONS DURING DOMESTIC TREATMENT OF WATER CONTAINING ORGANICS,
New Hampshire Univ., Durham. Dept. of Chemistry.
J. H. Weber, and R. E. Truitt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 147, Price codes: A03 in paper copy, A01 in microfiche. Water Resource Research Center, University of New Hampshire, Research Report No. 21, 1979. 29 p, 8 tab, 40 ref. OWRT A-046-NH(1). 14-31-0001-3829.

Descriptors: *Fulvic acids, *Coagulation, *Water treatment, *Filtration, Separation techniques, Ions, Ion removal, Alum.

Preliminary to water treatment experiments, several filter media were tested to determine $Cd2+$ losses during filtration at pH 8. The initial concentrations of $Cd2+$ were 4.5 and 45 ppb. Various filtering materials sorb different amounts of $Cd2+$ from solution as a function of their surface area and the speed of filtration. Polycarbonate filter membranes in combination with a polycarbonate support apparatus gave the lowest $Cd2+$ losses when the filtrate is collected directly in a volumetric flask. The effectiveness of $Cu2+$, $Cd2+$, and $Zn2+$ removal from solution by alum coagulation was measured with fulvic acid present and absent. A factorial experimental design and analysis of variance were used to determine the effect on metal ion removal of the individual variables pH, metal ion concentration, alum concentration, and fulvic acid concentration and their combinations. The variable levels model water treatment plant conditions. Maximum metal ion losses on 96% for $Cu2+$, 59% for $Cd2+$, and 82% for $Zn2+$ were measured in the presence of fulvic acid. In its absence the maximum metal ion losses were 93% for $Cu2+$, 14% for $Cd2+$, and 53% for $Zn2+$. Fulvic acid enhances metal ion removal under most experimental conditions. The practical implication on the results is that strong complexes between natural water organic matter and metal ions enhance their removal by the alum coagulation process.
W79-05046

IONIZATION CHAMBER FOR WATER TREATMENT SYSTEM,
Water-Tronics, Inc., Charlotte, NC. (Assignee).
C. N. Smith.
U.S. Patent No. 4,127,467, 7 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 986, No. 4, p. 1248, November 28, 1978.

Descriptors: *Patents, *Water treatment, *Scaling, Industrial water, Ionization, Demineralization, Electrodes, Equipment, Ionization chamber.

An ionization chamber for use in eliminating or controlling scale in water systems includes a generally cylindrical housing having a side wall and ends, and an electrode, extending within the housing along the longitudinal axis. The electrode and the housing are connected to the opposite poles of a source of direct current. The electrode projects into the housing through one end wall and the extending end of the electrode is spaced from the opposite end wall of the housing by a dimension substantially equal to the radial spacing between the electrode and the side wall of the housing. A dielectric sleeve is arranged about the electrode, and extends along the electrode from one end wall for a length corresponding to the spacing between the end of the electrode and the opposite end wall of the housing. As a result, the exposed electrically conductive portion of the electrode is substantially equally spaced at all points from the surrounding housing, whereby the electrical energy generated between the housing and the electrode is substantially evenly distributed throughout the ionization chamber. (Sinha-OEIS)
W79-05384

PROCESS FOR INHIBITING CORROSION OF METALS IN AQUEOUS SYSTEMS,
Hercules Inc., Wilmington, DE.
D. C. Zecher.
U.S. Patent No. 4,093,557, 8 p, 6 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 971, No. 1, p 279, June 6, 1978.

Descriptors: *Patents, *Water treatment, *Industrial water, *Cooling water, Corrosion, Corrosion control, Scaling, Organic compounds, Chemical reactions.

A process is described for inhibiting of corrosion of metal surfaces in contact with cooling water principally in open-recirculating cooling water systems by maintaining contact of the surfaces within the system with corrosion inhibiting compounds characterized by the presence of at least one quinomethide group within the compound. (Sinha-OEIS)
W79-05391

CONTROLLING IRON OXIDE DEPOSITION IN BOILER SYSTEMS,
Nalco Chemical Co., Chicago, IL.
For primary bibliographic entry see Field 3C.
W79-05498

BOILER WATER TREATMENT: IS THE PAPER INDUSTRY A SPECIAL CASE,
Betz Lab., Inc., Trevose, PA.
G. Levine.
TAPPI Engineering Conference, San Francisco, California, September 19-21 1978, Preprinted Proceedings (TAPPI, Atlanta, Georgia), p 233-241. 6 fig, 11 illus, 8 ref.

Descriptors: *Boiler feed water, *Water treatment, Industrial water, Pulp and paper industry, Water softening, Demineriladztion, Boilers, Iron compounds, Phosphates, Corrosion, Hydrogen ion concentration, Water quality, Condensates.

This article describes the uniqueness of water treatment in the paper industry and the means to cope with the problem. The major problem plaguing the industry is the quantity of iron corrosion products generated in the utility cycle and their subsequent deposition in the boiler. A well-managed and well-monitored external and condensate treatment program is vital to keep contaminants from reaching the boiler. Where iron is of concern, an ethylenediamine tetraacetic acid/dispersant program provides the best relief. If caustic corrosion is a potential problem, the use of a coordinated pH/phosphate control program will provide the necessary protection. Highly specific dispersants have also been developed for use in boilers where hardness contaminants have been the major problem. These dispersants distort and further inhibit the growth of deposition crystals, allowing them to be removed with the blowdown. (Witt-IPC)
W79-05499

5G. Water Quality Control

PLANT NUTRIENT LOSSES FROM FOLIAR-FERTILIZED SOYBEANS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. L. Baker, and J. M. Laflen.

Paper No. 78-2084, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 11 p, 5 fig, 1 tab, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Fertilization, Nutrient removal, Nutrients, *Foliar application, Runoff, Soybeans, Simulated rainfall, Corn.

To determine the impact of foliar-fertilization of soybeans on runoff water quality, simulated rainfall was applied to soybeans and corn receiving no fertilizer and to soybean plots foliar-fertilized (20 kg/ha N, 2 kg/ha P) 39 and 13 hr before rainfall. Washoff water from plants and surface runoff water were analyzed for NH4-N, NO3-N, total N, PO4-P, and hydrolyzable-P. Foliar-fertilization did initially increase concentrations of dissolved nutrients in runoff, but most N and P washed from plants was retained by the soil within plot areas. (Skogerboe-Colorado State)
W79-05056

THE FEDERAL GROUND-WATER PROTECTION PROGRAM--A REVIEW,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
V. J. Kimm.
Ground Water, Vol. 17, No. 1, p 75-79, January-February 1979. 3 append.

Descriptors: *Federal government, *Groundwater, *Water pollution control, *Water quality control, Environmental control, Legal aspects, Water quality, Water pollution, Water pollution sources, Pollutants, Water wells, Aquifers, Injection wells, Waste water disposal, Reviews.

The Nation's groundwater resources constitute a vast and often unprotected resource. The Environmental Protection Agency is about to launch a number of programs designed to protect what is, in many cases, a virtually nonrenewable resource. Separate regulatory activities mandated under the Safe Drinking Water Act, the Resource Conservation and Recovery Act, and the Clean Water Act must be coordinated carefully if they are to be effective. The current implementation efforts within the agency are being framed in view of our major principles which will be the focus of public comment in the months ahead. These principles are: (1) The administration of the related programs will be a cooperative effort involving Federal, State and local governments, all of which must participate in formulating the program if it is to be effective. (2) The focus of the programs will be on the prevention of contamination rather than on its treatment at the point of withdrawal. (3) The applicable standards will be based primarily on technology rather than ambient groundwater quality considerations since the effects of discharges upon ambient quality are complex, difficult to predict, and of long duration. (4) There is a need to balance environmental protection, energy development, and continued economic prosperity objectives so that the resulting programs fully protect public health while being realistically implementable. All of us--government, industry and citizens, through acts of commission or omission--have contributed to the potential problem. We must work together if we are to get on with the important task of protecting the quality of the Nation's groundwater resources. (Sims-ISWS)
W79-05127

THE FEDERAL GROUND-WATER PROTECTION PROGRAM--TODAY'S HOPE,
Environmental Protection Agency, Dallas, TX.
C. W. Sever.
Ground Water, Vol. 17, No. 1, p 80-82, January-February 1979.

Descriptors: *Groundwater, *Water pollution control, *Water quality control, *Federal government, Legal aspects, Water quality, Water pollution, Water pollution sources, Injection wells, Lagoons, Waste water disposal, Aquifers, Pollutants, Path of pollutants, Water supply, Water resources, Potable water.

The necessary administrative mechanisms for protection of our underground drinking water sources, and coordination of natural resource and energy development and environmental quality programs, should be provided by a federal groundwater control program, else today's underground contaminant disposal activities will be tomorrow's undoing. Federal regulations, however, must provide flexibility to States and industry to find the least costly means of meeting national environmental goals. A growing body of literature clearly documents cases of underground drinking water source contamination, sometimes severe, from a large variety of conditions and practices. Existing studies also indicate that this problem is pervasive: aquifers have been adversely affected in every region of the country. A federal groundwater protection program which (1) reflects consideration of total long-range natural resource protection and environmental quality benefits, (2) regulates in a manner so that the benefits to the environment generally exceed the regulatory costs, and (3) encourages more efficient ways of meeting environmental goals in the least costly manner can and must be developed by the Environmental Protection Agency. Without an effective Federal groundwater protection program, the underground contamination problem will likely worsen. (Sims-ISWS)
W79-05128

THE FEDERAL GROUND-WATER PROTECTION PROGRAM--TOMORROW'S UNDOING,
Wehran Engineering Corp., Middletown, NY.
D. C. Mosher.
Ground Water, Vol. 17, No. 1, p 83-86, January-February 1979. 5 ref.

Descriptors: *Groundwater, *Water pollution control, *Landfills, Water pollution, Water pollution sources, Landfills, Solid wastes, Waste disposal, Leachate, Leaching, Pollutants, Path of pollutants, Federal government, Legal aspects, Aquifers, Water resources, Water supply, Water quality, Water quality control.

Past and present guidance in landfilling has been based on inadequate information. More recent information indicates past and present recommendations/guidance may not be accurate. Current trends, as a result of RCRA (PL 94-580), are generally following the same recommendations. The result can be greater problems from landfills constructed now and in future years than have occurred from past landfills, such as the well-known Llangollen landfill. It is time for Congress, EPA, and others to recognize what is and is not known about the pollution potential from landfills and waste disposal in general. (Sims-ISWS)
W79-05129

STATE GROUND-WATER PROTECTION PROGRAMS--A NATIONAL SUMMARY,
Environmental Protection Agency, Chicago, IL. Region V.
R. E. Bartelt.
Ground Water, Vol. 17, No. 1, p 89-93, January-February 1979. 6 fig, 1 ref.

Descriptors: *Groundwater, *Water pollution control, *State governments, *Legal aspects, Reviews, Surveys, Legislation, Water pollution, Water pollution sources, Pollutants, Injection wells, Waste water disposal, Chemicals, Oil, Path of pollutants, Aquifers, Water quality, Water quality control.

In order to discuss the adequacy or inadequacy of State groundwater protection programs, it is helpful to establish a base line which may be used as a frame of reference for the discussion. To provide that frame of reference, the 50 States were contacted and representatives were questioned as to the nature and extent of their existing groundwater programs. The survey of States produced a wealth of information relative to the structure of various State programs, and this information was presented graphically in the neutral presentation. The subject of multiple agency involvement was addressed. In addition to looking at the structure of State programs, information was collected regarding the nature of existing State statutes and regulations. Tabulation and interpretation of this information were provided to illustrate how the institutions are providing for the protection of our groundwater resources. In addition to evaluating the various types of statutes, existing enforcement mechanisms were researched and presented for review. Graphic presentations of the national data base were used, and again several States' procedures were reviewed in detail. The topic of groundwater quality standards was specifically addressed during interviews in order to note the extent of this developing regulatory technique. The presentation provided a national look at existing groundwater programs with in-depth analysis of certain State programs. The variations in State programs were highlighted and an attempt was made to estimate resources currently dedicated to groundwater protection at the State level. (Sims-ISWS)
W79-05130

STATE GROUND-WATER PROTECTION PROGRAMS--INADEQUATE,
Virginia State Water Control Board, Roanoke. West Central Regional Office.
J. W. Dawson.
Ground Water, Vol. 17, No. 1, p 102-108, January-February 1979. 12 fig, 4 ref.

Descriptors: *Groundwater, *Water pollution control, *State governments, *Legal aspects, Reviews, Surveys, Water quality standards, Water resources, Pumping, Water wells, Drilling, Water policy, Water management(Applied), Legislation, Administration agencies, Aquifers, Water quality, Water quality control.

The primary reason state groundwater protection programs are inadequate is that the resource is misunderstood, surrounded by misconceptions and, due to its occurrence, is 'out of sight and out of mind.' To most people, groundwater is a very elusive and somewhat magical resource, whose significance in the over-all picture of water resources has not been realized by those who have the power and authority to rectify the present state of affairs. The need for adequate protective legislation and sufficient financial and manpower resources commitment is even more difficult to justify because, to date, there has not been a citizen outcry for such measures. To ascertain the status of current state groundwater protection programs, a survey of state legislation concerning groundwater was undertaken; additionally, a questionnaire was sent to the agency in each state responsible for administration of groundwater protection programs. The results of this survey indicate that most states have broad authority over groundwater resources through general water resources legislation, but the majority do not have specific groundwater protective legislation. In many cases, the broad legislative authority is inadequate or, if legislation is adequate, implementation of legislative mandates is not sufficient to provide adequate protection. Lack of groundwater quality and quantity data is severe to the point that many agencies do not have a realistic characterization or identification of the groundwater resources they are to protect. (Sims-ISWS)
W79-05131

STATE GROUND-WATER PROTECTION PROGRAMS--ADEQUATE,
Minnesota Dept. of Health, Minneapolis.
E. H. Ross.
Ground Water, Vol. 17, No 1, p 94-101, January-February 1979. 11 fig, 3 tab, 15 ref.

Descriptors: *Groundwater, *Water pollution control, *State governments, *Legal aspects, *Minnesota, Costs, Economics, Water resources, Water quality, Water quality control, Education, Aquifers, Political aspects.

An assessment of the adequacy of State involvement should include a historical perspective of resource management in the nation. A review of the record indicates that up until the 70's, Federal policy was virtually nonexistent with respect to groundwater protection programs. Efforts of the

groundwater industry and related scientific community to gain legislative action have shown progress within State government within the last few years. The Federal EPA, in response to efforts of the only significant constituency, the NWWA, is now requiring groundwater protection in their regulations. Institutional arrangements, whether national, State, or local, at least for some years to come by political necessity will require central involvement of the States in groundwater protection. The legislative and executive branches in many States have shown their willingness to act; however, without an active political constituency, legislative appropriations are provided after actual problems arise due to drought or contamination problems. Rainfall provides extra time to address quantity problems, but there may not be a second chance to protect groundwater quality. These branches of government have the monetary and legal authority to act once the need is demonstrated. The record of the judicial branch indicates a need for the legislative and executive branches to design and manage programs that will avoid the necessity of court action. Continued advocacy efforts for groundwater protection programs yet remain the responsibility of the water well industry and a small groundwater technical constituency. The public and the politicians need to be further informed and educated about the need for groundwater protection. (Sims-ISWS)
W79-05132

NON-POINT WATER QUALITY MODELING IN WILDLAND MANAGEMENT: A STATE-OF-THE-ART ASSESSMENT (VOLUME II - APPENDIXES).
Forest Service, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 949, Price codes: A25 in paper copy, A01 in microfiche. Ecological Research Series, EPA-600/3-77-078, Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, Georgia, July 1977. 567 p, 3 append. EPA-IAG-D5-0660.

Descriptors: *Watersheds(Basins), *Forestry, *Wildland management, *Non-point source pollution, Effects, Water quality, Erosion, Simulation analysis, Runoff, Planning, Mathematical models, Methodology, Monitoring, Aquatic ecosystem, Predictive models, Systems analysis.

Presented is Volume II of a report which assesses and reviews forestry management activities that can increase the non-point pollutant source potential, the effectiveness of demonstrated control techniques to reduce this potential, the usefulness and reliability of existing non-point source controls, and an evaluation of the water quality data base available for model development and testing. This volume contains: (a) the model evaluation forms that were completed for each model evaluated; (b) the watershed inventory forms that were compiled for each of the inventoried watersheds; and (c) a summary that references the models by number and predictive category. (See also W79-05269) (Bell Graf--Cornell)
W79-05270

FEASIBILITY STUDY ON EXECUTIVE PROGRAM DEVELOPMENT FOR BASIN ECOSYSTEM MODELING,
State Univ. of New York Coll. at Plattsburgh. Dept. of Computer Science.
H. Bouver.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 961, Price codes: A06 in paper copy, A01 in microfiche. EPA-600/3-78-034, Ecological Research Series; Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA., March 1978. 69 p, 153 ref, 7 append.

Descriptors: *Simulation analysis, *Computer programs, *Feasibility studies, *Computer models, *Water quality, *Interactive graphic display, Systems analysis, Basin-wide, Point source, Nonpoint source, Urban water quality modeling, Graphic executive program, Programming modules, Database, Data-structure, Computer language.

The feasibility of developing and implementing a complete graphic executive program to automatically interface various basin-wide water quality models for use by relatively inexperienced modelers was examined. Because of a number of problems, including data base management difficulties, the study recommends the development of a 'pilot' version to resolve questions before full-scale implementation of the environmental system is attempted. The executive program should ultimately have the capability to integrate point and nonpoint source models to simulate and analyze the consequences of implementing land use alternatives and pollution control strategies. To reflect accurately the present state of the art, the study examined interactive computer graphics display and software design to automatically interface basin ecosystem submodels. In addition, a literature review was made to assess the state-of-the-art of urban water quality mathematical modeling relative to its modularization for the executive program. Particular attention was addressed to interactive computer graphic display as the medium in which this executive program would be primarily used. (Bell-Graf-Cornell)
W79-05285

ALGAE AND WATER POLLUTION,
For primary bibliographic entry see Field 5C.
W79-05322

PHYSICAL QUALITY AND SEDIMENT TRANSPORT IN DRAINAGE WATER FROM A MANURED AND FERTILIZED CROPPING OPERATION,
Department of Agriculture, Ottawa (Ontario). Animal Research Inst.
N. K. Patni.
Journal of Environmental Science and Health, Vol. 13, No. 3, 1978, p 269-285. 1 fig, 7 tab, 13 ref.

Descriptors: *Sediments, *Agricultural runoff, *Land application, *Manure, *Crop production, *Farm management, *Greenbelt Farm(Ontario, Canada), *Water quality control, Water pollution sources, Drainage water, Watersheds(Basins), Streams, Canada, Ontario(Canada), Dissolved solids, Conductivity, Sediment transport, Soil erosion, Snowmelt, Hydrology, Nutrients, Fertilization, Farm wastes, Livestock, Rotations, Cultivation, Data collections.

A three-year investigation (1975-77) of effects on drainage water quality and sediment transport of large-scale plowdown of liquid manure into cropland on 594-ha Greenbelt Farm, a research area at Ottawa, Ontario, Canada, showed that with proper management good drainage water quality can be maintained. Such management practices include: (1) immediate plowdown of manure after application, (2) restriction of manure application to relatively dry periods, (3) provision for manure storage during wet weather and winter, (4) rotation of fields subject to manure application, and (5) application away from stream banks. Most annual sediment transport occurred during snowmelt runoff, and the amount of solids transported from agricultural land was greatly influenced by hydrological flow conditions (longer periods of heavy, turbulent flows in 1976 resulted in greater net transport compared to 1977). Specific conductivity measurements were useful for quick estimates of dissolved solids content in drainage water. Large quantities of liquid manure have been incorporated into the soil every year (mid-April to mid-December) since 1968. Manure was derived 65% from dairy cattle, 30% from sheep, and about 5% from poultry. Four incoming and two outgoing streams were monitored. The cropped area (96% of the basin) is under a 3-5 year rotation of corn and mixed legume-grass, with some small grain. (Lynch-Wisconsin)
W79-05339

BALLASTED FLOATING BARRIER BOOM,
Conwed Corp., St. Paul, MN. (Assignee).
I. I. Niemi, and K. S. Peterson.
U.S. Patent No. 4,129,989, 5 p, 5 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 3, p 706, December 19, 1978.

Descriptors: *Patents, *Oil pollution, *Water pollution control, *Water quality control, Floating, Barriers, Oil booms, Containment.

A floating ballasted oil containment boom provides a stable continuous barrier to the passage of petroleum or other contaminants floating on the surface of water. Boom elements are connected end to end by an overlapping joint. The boom is made of a closed-cell flexible plastic foam and is formed to make a longitudinal pocket. The longitudinal pocket is filled with a ballast material having a specified gravity greater than that of the liquid on which it is to float. The ballast material is preferably granular to enable the boom to be rolled up. For containment of certain industrial pollutants other than petroleum which may attack a polyethylene boom, or for use on liquid bodies other than water, other buoyant materials may be used without departing from the spirit and scope of this invention. (Sinha-OEIS)
W79-05376

OIL SEPARATION MATERIAL,
British Petroleum Co. Ltd., London (England). (Assignee).
R. J. R. Cairns, and J. M Howard.
U.S. Patent No. 4,129,499, 5 p, 10 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 2, p. 537, December 12, 1978.

Descriptors: *Patents, *Oil pollution, *Water quality control, Water pollution treatment, Water purification, Separation techniques, Coalescence, Dispersion, Coals, Dispersants, Purification beds.

A method for separating oil from water contaminated with oil comprises passing a contaminated water stream through spaced apart purification beds containing solid particles in such manner that the oil coalesces and an oil phase and a water phase are formed. Materials which can be used in particulate form in the purification beds incude anthracite, charcoal polystyrene, polyethylene and polypropylene. Such materials, while very useful for coalescing fresh water contaminated with oil, are not particularly effective for treating sea water. It has now been discovered that treating the purification bed packing material with certain polymers improves its coalescing performance with respect to oil-salt water mixtures. The method comprises: contacting the particles with a solution of a dispersant additive; treating the contacted particles with a hydrocarbon activating agent; and/or carrying out both steps simultaneously. (Sinha-OEIS)
W79-05378

FLOATING-REFUSE-COLLECTING BOAT,
Mitsubishi Jukogyo Kabushiki Kaisha, Tokyo (Japan). (Assignee).
H. Oguran, H. Asakawa, J. Kondoh, M. Nakamura, and S. Oyaide.
U.S. Patent No. 4,128,068, 5 p, 5 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 1, p 67, December 5, 1978.

Descriptors: *Patents, *Water pollution control, *Water quality control, Skimming, Solid wastes, Flotsam, Jetsam, Ships, Jets, Harbors, Rivers, Equipment, Floating solid wastes, Twin-hull boats.

A floating-refuse-collecting boat of a twin-hulled construction includes a floating-refuse collector located in the water channel formed between the hulls. Main water-jet units are installed on the bows of the hulls for directing jets of water rearward through the water channel for guiding and forcing the refuse afloat in the vicinity of the entrance into the channel and toward the collector. In addition, auxiliary water-jet units are mounted on the hulls rearward of the main water-jet units and in front of the collector to provide jets of water which prevents refuse from flowing out of the collector when the boat moves astern. (Sinha-OEIS)

W79-05380

PROCESS FOR PURIFYING WASTE WATER OBTAINED BY A PAPERMAKING PROCESS,
Lilla Edet Aktiebolag (Sweden). (Assignee).
For primary bibliographic entry see Field 5D.
W79-05386

POLLUTING OIL RECOVERY APPARATUS,
P. J. Strain.
U.S. Patent No. 4,120,793, 4 p, 2 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 3, p 1102, October 17, 1978.

Descriptors: *Patents, *Oil pollution, *Oil spills, *Water pollution treatment, *Water quality control, Separation techniques, Ships, Equipment, Sluice gates, Baffles, Flow, Oil recovery.

After a series of booms has enclosed or partly enclosed a patch of spilled oil on the water, the recovery ship, which has booms attached to the sides, advances bow forward into the oil. A series of sluice gates are provided at the bow into which the oil flows. The oil with water drawn into the sluice gates of the ship is pumped into a heated conduit directed within the ship toward its stern. Within the conduit a series of baffles are deployed as valves to allow water to pass along the conduit but having means to draw off any oil which has sought its natural position on the surface of the flowing water-oil mixture in the conduit. As a final separation means, a U bend is provided to the conduit travelling downward into the bottom of the ship and upwards again to a water discharge outlet. As the mixture is allowed periodically to rest in the U bend the remaining oil in the mixture settles in the upper portion of the U bend where it is extracted. More than one U bend can be provided in each conduit if necessary. (Sinha-OEIS)
W79-05390

CONTROL OF OIL POLLUTION BY REMOTE SENSING ALONG THE SHORES OF FRANCE,
French Embassy, Washington, DC.
For primary bibliographic entry see Field 7B.
W79-05392

REMOTE SENSING OF THE OCEANS - A REVIEW,
Aircraft Research and Development Unit, Edinburgh (Australia).
For primary bibliographic entry see Field 7B.
W79-05394

IMAGE ENHANCEMENT OF SIDE-SCAN SONAR MAPPING,
California Univ., Santa Barbara.
For primary bibliographic entry see Field 7B.
W79-05395

THE USE OF LANDSAT IMAGERY FOR MARINE POLLUTION STUDIES,
Singapore Univ.
For primary bibliographic entry see Field 7B.
W79-05396

STORMWATER MANAGEMENT MODEL: TRANSFER OF TECHNOLOGY,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
For primary bibliographic entry see Field 5B.
W79-05412

VARIABILITY OF ANNUAL NUTRIENT AND SEDIMENT DISCHARGES IN RUNOFF FROM OKLAHOMA CROPLAND AND RANGELAND,
Agricultural Research Service, Durant, OK. Water Quality Management Lab.
For primary bibliographic entry see Field 5C.
W79-05429

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

MOBILE BAY HYDROGRAPHY UNDER FLOOD STAGE CONDITIONS,
Alabama Univ., University. Dept. of Chemical and Metallurgical Engineering.
For primary bibliographic entry see Field 2L.
W79-05008

MATHEMATICAL MODELING OF SURFACE WATER IMPOUNDMENTS, VOLUME: I, AND II,
Resource Management Associates, Lafayette, CA.
For primary bibliographic entry see Field 2H.
W79-05011

TRANSIENT SUBSURFACE DRAINAGE ON SLOPING IRRIGATED LAND,
Bechtel, Inc., San Francisco, CA.
H. J. Yeh, and L. G. King.
Paper No. 78-2037, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 21 p, 7 fig, 15 ref, ASAE, St. Joseph, Michigan.

Descriptors: *Subsurface drainage, Subsurface drains, *Irrigated land, Canal seepage, Slopes, Interception, Numerical analysis, Water table, Irrigation, Hydrodynamics.

Parallel subsurface drains on sloping land were studied. Source of water was upslope seepage such as from a canal as well as intermittent irrigation over the drains. The ground surface was treated as a boundary so that both fully and partially saturated flow conditions existed within the soil region under study. The water table location was determined from the numerical solution of hydraulic head as a function of space coordinates. ADI methods were used to solve the basic partial differential equation together with appropriate initial and boundary values. Land slopes of up to 15 degrees from the horizontal were studied. Water table fluctuation and drain discharge were obtained over several irrigation cycles. During recession of the water table following an irrigation, the location of the maximum water table height between the drains moved toward the lower drain. The water table recession following an irrigation was compared with existing theories using only saturated flow for parallel drains on flat land. The results of this study showed the water table height as a function of time to be greater than predicted by existing theories even for quite small slopes. The effects of partially saturated flow and land slope on this result are discussed. (Skogerboe-Colorado State)
W79-05052

INTERACTIVE MULTIPLE OBJECTIVE OPTIMIZATION,
Purdue Univ., Water Resources Research Center. Lafayette, IN.
K. J. Musselman, and J. J. Talavage.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 211, Price codes: A10 in paper copy, A01 in microfiche. Technical Report No 121, February 1979. 196 p, 30 fig, 12 tab, 64 ref, 3 append. OWRT B-083-IND(10).

Descriptors: *Optimization, *Urban drainage, *Detention reservoirs, Algorithms, Storm water, Reservoir storage, Drainage system, Drainage basin, Nonlinear programming.

Decision problems often arise in which several, non-commensurate and conflicting objectives must be considered simultaneously. This report is concerned with first investigating a general nonlinear class of these problems and then developing a means of solving problems found in this class. The results are divided into four related areas: (1) identifying properties and relationships which exist within this class of problems and which prove useful to their resolution, (2) developing a user-oriented algorithm, using these properties, to solve nonlinear multiple objective optimization problems, (3) applying the algorithm to a representative problem and (4) modifying the algorithm to address discrete nonlinear multiple objective optimization problems. A decision problem concerned with the expected storm drainage needs of an urban subbasin is analyzed by means of the algorithm. The problem involved minimizing various pollutant loads and costs by adjusting the drainage systems local detention storage capacity, maximum treatment rate and maximum allowable overflow rate. Convergence results are shown for several tradeoff policies. The tradeoff algorithm is modified to resolve the question of how to find integer solutions to the nonlinear multiple objective optimization problems. The peculiar difficulties involved with directly applying the continuous version of the algorithm are discussed in detail.
W79-05092

WATER-QUALITY INVESTIGATION OF THE VACHE GRASSE CREEK WATERSHED, SEBASTIAN COUNTY, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb.
Geological Survey open-file report 78-903, 1978. 25 p, 2 fig, 5 tab, 11 ref.

Descriptors: *Baseline studies, *Water quality, *Water analysis, *Watershed management, Chemical properties, Topography, Geology, Physical properties, Sampling, Arkansas, Pre-Soil Conservation Service programs, *Vache Grasse Creek watershed, Sebastian County.

The results of a 1-year study in the upper Vache Grasse Creek watershed, Sebastian County, AR., are presented to document surface-water quality conditions before implementation of Soil Conservation Service programs. Analysis of samples collected at four sites showed that during periods of warm weather several of the parameters sampled produced unusually high or low values that indicated possible water-quality problems. Low dissolved-oxygen concentration, high nitrogen and organic carbon concentrations, and high coliform bacteria counts were at sampling sites upstream from the Greenwood water-supply lake. Sampling in and downstream from the lake indicated that the quality of the water passing through the lake was improved significantly. However, sampling in the lake indicated that there is a large layer of water with low oxygen concentration and a buildup of phosphorus, iron, manganese, and some other metals in the bottom ooze. (Woodard-USGS)
W79-05158

MATHEMATICAL MODELING OF WATER QUALITY,
Cambridge Univ. (England). Control and Management Systems Div.
M. B. Beck.
CP-78-10. Summary Report of a IIASA Workshop, September 13-16, 1977, Laxenburg, Austria. International Institute for Applied Systems Analysis, Laxenburg, Austria, October 1978. 50 p, 50 ref.

Descriptors: *Water quality, *Mathematical models, *Systems analysis, Rivers, Lakes, Reservoirs, Estuaries, Pollutants, Planning, Management, Ecology, Design, Eutrophication, Nitrogen cycle, Real-time, France, Rhine River(Germany), Hydrophysics.

Summarized are the proceedings of an IIASA Workshop on Water Quality Modeling held at Laxenburg, Austria, September 13-16, 1977. The Workshop was held as an initial activity within IIASA's research Task on Models for Environmental Quality Control and Management. In convening the Workshop, the organizers invited participants to express their views on the current state of mathematical modeling of water quality. They were encouraged also to speculate on future directions for the subject and to make recommendations for the ways in which such research could be

organized in collaboration with IIASA. The report on the Workshop is divided broadly into two sections: the first deals with key themes and salient problems of water quality modeling; the second reproduces the concluding statements of nine ad hoc working groups established during the Workshop. These working groups considered a number of specific areas, such as deep lakes and reservoirs, the impact of toxic pollutants, systems methods in model development and analysis, and so forth. An intermediate section of the report briefly considers future perspectives in water quality modeling. In the final section, particular reference is made to the Institute's plans for water quality model development and application in particular case studies. (Bell Graf--Cornell)
W79-05273

COLLECTIVE DECISION MAKING IN WATER RESOURCE PLANNING,
Virginia Univ., Charlottesville.
R. Burke, III, and J. P. Heaney.
Lexington Books, D.C. Heath Company, Lexington, Massachusetts, (and Toronto, Canada) 1975. 260 p, 23 fig, 22 tab, 673 ref.

Descriptors: *Water resources, *Planning, *Decision making, *Collective action, Methodology, Mathematical models, Systems analysis, Equations, River basins, Management, General theory, Synergistic behavior, Complexity, Antireductionism, Social systems, Holistic reasoning.

Basically, this book assumes that contemporary water resource problems are actually symptoms of another more fundamental malady: the lack of a general, over-arching set of guiding principles for water-related planning and decision making. It is assumed also that theory and concept are the best guides to reasoned action. 'Synergistic behavior' and 'Complexity' are two primary characteristics of the general water resource situation and must be addressed as we develop theories and methodologies. In order that the basic synergism of the water resource system be given proper viability, these theories and methodologies must rest on a fundamental reasoning from whole-to-part. For this book, a definition of three different levels of complicatedness/complexity is given. The book moves from describing the largest systems to probing deeper into sublayers. Three additional concepts from a unifying thread through each chapter: systems, structure, and process. Specifically, the eight chapters herein consider: (1) the disparity between capabilities of existing planning and decision models and the requirements of the external planning environment; (2) an integrating framework, using Parsons' 'general theory of action;' (3) current systems thinking in planning theory, drawing on Ozbekhan's 'general theory of planning, and showing how water resource planning meshes with the larger system, the societal overlayer; (4) introducing 'process' into the analysis as a means of giving life to those broader structural concepts (9 bipolar dimensions are used to characterize any decision situation); and (5) the application of simulation to a water quality problem in hypothetical Bow River Valley. (Bell-Graf--Cornell)
W79-05274

A MULTIDISCIPLINARY TRANSFER MODEL FOR WATER MANAGEMENT KNOWLEDGE TRANSFER IN DEVELOPING COUNTRIES,
Colorado State Univ., Fort Collins. Dept. of Economics.
J. Eckert.
In: Water Knowledge Transfer. Volume 1, Proceedings of the Second International Conference on Transfer of Water Resources Knowledge, June 1977, Fort Collins, Colorado. N.S. Grigg, et al., Eds., Water Resources Publications, Fort Collins, Col., 1978, p39-63.

Descriptors: *Water management(Applied), *Transfer knowledge, *Multidisciplinary transfer model, *Developing countries, Farms, Economics, Agriculture, Water loss, Design, Programs, Technology, Efficiencies, Transfer process, Data sources, Data sources, Ditches, Information needs, Systems analysis.

Rural economic vitality and growth depend very largely on agricultural productivity. Efficient on-farm water management contributes to rural economic growth, in at least four ways, avoiding: (1) wasted or poorly-applied water for providing soil moisture; (2) inefficient transition to a modern agricultural system; (3) much of the annual variability in yields; and (4) excessive loss in delivery and application. Thus there is considerable information on both theoretical and practical aspects of water management which is vitally needed by farmers in developing countries today. This paper develops a process whereby this information can be assembled, evaluated by certain criteria, and used to build improved water management practices which can be widely adopted. Needed is an incentive structure that stresses other things than income maximization and a constraining institutional environment. Suggested is such a structure, including the types of information needed, the sequence of analyses and actions that must be considered, and a description of some of the possible linkages between subcomponents. The transfer process developed herein draws on concepts from agricultural engineering, agronomy, agricultural economics, sociology and political science. Presented is a decision model which draws heavily on the experience of Colorado State University's water management project in Pakistan. The model's principle limitation is its restricted applicability to areas of abundant water supply such as the humid tropics. (See also W79-05409) (Bell-Graf-Cornell)
W79-05411

6B. Evaluation Process

CONTINUOUS SIMULATION FOR WATER QUALITY PLANNING,
Hydrocomp, Inc., Palo Alto, CA.
A. S. Donigian, Jr., and R. K. Linsley.
Water Resources Bulletin, Vol. 15, No. 1, p 1-16, February 1979. 9 fig, 3 tab, 15 ref. OWRT C-6134(5215)(3), 14-31-0001-5215.

Descriptors: *Water quality control, *Alternative planning, *Simulation analysis, Economic impact, Benefits, Methodology, Evaluation, Costs, Decision making, Aeration, Watersheds(Basins), Economic efficiency, Cost-effectiveness, Dissolved oxygen, Systems analysis.

Described is a methodology for the evaluation of water quality plans analogous to procedures used in flood control planning, where flood damage frequency curves provide the basis for determining flood control benefits. The proposed method uses continuous water quality simulation to develop long-term information from which water quality frequency curves can be obtained. This frequency information allows the evaluation of the impact of proposed water quality control plans taking into consideration the variable nature of the water resource. Using treatment costs and other economic indicators of water quality, the frequency information can be used to estimate the cost-effectiveness and economic efficiency of alternative plans. The method is demonstrated in a semihypothetical environment; real hydrologic and climatic characteristics are assigned to a hypothetical watershed configuration. Alternative management plants are simulated and analyzed for both physical and economic impacts. The advantages of continuous simulation and its use in water quality planning are explored. (Bell-Graf--Cornell)
W79-05010

DEFINING UPPER LIMITS TO GROUNDWATER DEVELOPMENT IN THE ARID WEST,
Montana State Univ., Bozeman.
For primary bibliographic entry see Field 4B.
W79-05271

WATER PRODUCTION FUNCTIONS FOR IRRIGATED AGRICULTURE,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W79-05275

EVALUATION OF PROPOSED STORAGE SITES,
Woodward-Clyde Consultants, San Francisco, CA.
R. L. Keeney.
Operations Research, Vol. 27, No. 1, p 48-64, January-February 1979. 4 fig, 6 tab, 4 ref.

Descriptors: *Pumped storage, *Sites, *Ranking, *Screening, *Preference structure, *Sensitivity analysis, Hydroelectric generation, Surface waters, Groundwater, Trsansmission lines, Evaluation, Equations, Risks, Uncertainty, Scaling factors, Utility functions, Invariant value tradeoffs, Ecological impacts, Costs, Technological concerns, Environmental aspects, Economic concerns, Decision making, Southwest US, Mathematical models, Systems analysis.

Screening models and on-site visits by a team composed of engineers, geologists, and biologists were used to identify ten sites in the Southwest suitable for developing a pumped storage facility with a 600 MW capacity. This paper discusses the decision analysis used to rank the sites. The study included the consideration of economic, environmental, and technological concerns relating to the sites and their required transmission lines. Using sensitivity analyses, factors critical to the ranking were identified: uniqueness of the riparian community; uncertainties; and changes in the value tradeoffs, risk attitude and problem definition. (Bell-Graf--Cornell)
W79-05277

ECONOMICS OF IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W79-05292

AN ECONOMIC VALUATION OF RECREATIONAL CLAMMING IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.
R. W. Smith, J. M. Conrad, and D. A. Storey.
Research Bulletin No. 654, Massachusetts Agricultural Experiment Station, April 1978. 98 p, 7 fig, 30 tab, 19 ref, 3 append.

Descriptors: *Value, *Clamming, *Recreation demand, *Massachusetts, *Economics, *Planning, *Regulation, *Willingness-to-pay, Permits, Clams, Surveys, Intertidal areas, Coasts, Resource allocation, Ipswich(MA), Orleans(MA), Scituate(MA), Cost-benefit analysis, Resource management, Mya arenaria, Mercenaria mercenaria, Ensis directus, Fisheries, Mathematical studies, Water pollution effects, Economic efficiency, Decision-making, Quahogs, Soft-shelled clams.

An opinion survey of 267 clamming permit holders (pertaining to 1975) in the Massachusetts towns of Ipswich, Scituate, and Orleans, demonstrated the feasibility of establishing dollar estimates of the value of recreational clamming. This nonmarketed good previously has been described only in terms of participant number and harvest estimates. Willingness to pay for, or to surrender permits were compared with town expenditures for regulation programs. The research objective was to improve planning and decision-making in shellfish resource management. The estimates must be considered only approximations, however, since they do not reflect actual market conditions; in particular, willingness to pay values are probably underestimated. 1974 expenditures for shellfish regulation were $30,000 in Ipswich, $20,000 in Orleans, and $5,600 in Scituate. Scituate's expenditures clearly were economically justified when compared with the $20,400 willingness-to-pay value of its clam resources; Scituate had no commercial shellfisheries in 1975. $5,100 in permit fees were collected from nonresidents, and the remaining $500 in net expenditures compared favorably with $11,700 in resident benefits based on their willingness to pay.

Commercial harvests in Orleans and Ipswich 5-7 times larger than noncommercial harvests complicated the analysis, but recreational program expenditures clearly were economically justified. This paper also discusses clam species, ranges, and harvests; permit fees, restrictions, and water pollution. (Lynch-Wisconsin)
W79-05316

A MODEL FOR COST OPTIMIZATION OF BARGE SHIPMENTS,
Missouri Univ.-Rolla. School of Engineering.
For primary bibliographic entry see Field 6C.
W79-05317

A 'PUTTY-CLAY' APPROACH TO AGGREGATION OF PRODUCTION/POLLUTION POSSIBILITIES: AN APPLICATION IN DAIRY WASTE CONTROL,
California Univ., Berkeley.
L. J. Moffitt, D. Zilberman, and R. E. Just.
American Journal of Agricultural Economics, Vol 60, No 3, p 452-459, August 1978. 2 fig, 3 tab, 21 ref. (UCAL-WRC-W-536).

Descriptors: *Santa Ana River basin(CA), *Putty-clay approach, *Economics, *Dairy industry, *Water pollution control, *Pollution taxes(Charges), *Standards, *Methodology, Water quality standards, California, River basins, Regulation, Industrial wastes, Waste water disposal, Water pollution sources, Analytical techniques, Aggregates, Industrial production, Policy, Manure, Political constraints, Optimization, Pollution abatement, Incentives, Mathematical models, Model studies.

Taxes would be more effective than applied standards in controlling pollution caused by manure-loaded dairy wash water in California's Santa Ana River basin; this finding is borne out by use of the theoretical 'putty clay' production framework (Johansen, 1972), in which the relationship between aggregate economic variables and environmental policy instruments is assessed with empirical data. Since the cost to the industry would be greater with the tax approach, however, redistribution of tax revenues back to the industry may be necessary as a political incentive for policy acceptance. The approach used in this paper concentrates on the variability of production techniques and parameters across firms, instead of the traditional method of using the response of a representative firm to pollution controls as a measure of industry response. With the framework developed by Johansen, aggregate relations incorporating the response of individual firms can be derived for the short run. This paper demonstrates use of the procedure to determine short-run relations between environmental policy goals and instruments, and to determine optimal taxes and standards. The 'putty-clay' concept of the framework, which assumes that capital goods (such as machinery) are so specialized that their input-output ratio cannot be changed after installation, justifies aggregation based on empirical estimation of the distribution of input-output coefficients. (Lynch-Wisconsin)
W79-05318

ENDOGENOUS BIAS IN TECHNICAL PROGRESS AND ENVIRONMENTAL POLICY,
Temple Univ., Philadelphia, PA. Dept. of Economics.
R. A. McClain.
The American Economic Review, Vol 68, No 4, p 538-546, September 1978. 5 fig, 17 ref.

Descriptors: *Pollution abatement, *Environmental policy, *Technology, *Economic growth, *Economics, *Mathematical models, *Environmental effects, Costs, Model studies, Pollution taxes(Charges), Regulation, Standards, Political constraints, Zero pricing, Natural resources, Pollutants, Policy, Labor, Wages.

The likelihood that technical progress, because of market forces, degrades the environment is confirmed by means of two models representing different approaches to the impact of economic variables on labor and capital productivity, and on pollution per unit of output. The two models suggest similar conclusions for environmental policy: (1) zero pricing of environmental amenities means that pollution increases more rapidly than production; and (2) if pollution is to be stabilized in a growing economy, the price of pollution must not only be positive but flexible upward, and must rise at least at the same rate as labor productivity and wages. The approaches used were: (1) the innovation-possibility frontier approach, and (2) Nordhaus' more general 'isotech' approach. An isotech is the set of all techniques attainable at the same given cost, and the family of isotechs defines the technological opportunities available at a particular time. To fulfill the flexibility requirement for pollution prices, quantitative regulation may be the best politically feasible approach to environmental management. Direct legislation of such penalties as pollution taxes does not appear to provide the appropriate flexibility. A market for pollution rights or the Baumol approach would provide such flexibility. (Lynch-Wisconsin)
W79-05319

SLUDGE TO LAND--ECONOMIC CONSIDERATIONS FOR WATER AUTHORITIES,
Water Research Center, Medmenham (England). Medmenham Lab.
R. W. Bayley, and G. Hoyland.
Water Services, Vol 82, No 990, p 531-535, August 1978. 4 fig, 5 tab.

Descriptors: *Land application, *Sewage sludge, *Sludge disposal, *Sludge treatment, *Economics, *Costs, Water management, Sewage treatment, Fertilization, Agriculture, Crop production, Methodology, Alternative costs, Sewage lagoons, Lime, Centrifugation, Thickening, Stabilization, Sludge digestion.

Disposal costs were evaluated for five methods of treating sewage sludge prior to utilization on farm land were evaluated: (1) untreated sludge, (2) stabilization with lime, (3) anaerobic digestion in treatment lagoons, (4) gravity thickening followed by digestion, and (5) centrifugation followed by digestion. At small works (20,000 population) disposal of untreated or lime-stabilized sludge may be most economical. At larger works (100,000 population) methods involving digestion are economically competitive, especially for disposal of a thin sludge to a distant site. Centrifuging before digestions can be economical on a large scale for thin sludge. Lagooning is the most economical treatment method at large works (500,000 population) and very competitive at medium-sized works. In some areas untreated liquid sludge is acceptable for farm use, while in others some form of stabilization or conditioning is preferred. This variation is reflected in disposal costs. Overall costs were estimated from capital and operating costs of the constituent processes, and include costs of treating recycled supernatant liquors. Comparisons were evaluated on the basis of unit costs (pounds sterling/t dry solids from the primary sedimentation tank) calculated from the total annual cost and rate of production of dry sludge solids. Cost figures are provided. (Lynch-Wisconsin)
W79-05320

THE ECONOMIC VALUE OF IRRIGATION WATER IN THE WESTERN UNITED STATES: AN APPLICATION OF RIDGE REGRESSION,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
M. D. Frank, and Bruce R. Beattie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 610, Price codes: A07 in paper copy, A01 in microfiche. Texas Water Resources Institute, Texas A and M University Technical Completion Report No. 99, March 1979. 195 p, 20 tab, 13 fig, 5 append, 59 ref. OWRT A-034-TEX(1). 14-34-0001-6045, 7091, 7092, 8046.

Descriptors: *Irrigation water, Water demand, Regression analysis, *Water values, Western United States.

This study reports marginal water values and demand elasticities for eleven major irrigated regions in the West. Agricultural output in each region was hypothesized to take the form of a multiplicative function with nine domain variables--irrigation water applied, value of land and buildings, hired labor expenditures, fuel and lubricant expenditures, fertilizer and lime expenditures, feed expenditures, value of machinery inventory, value of livestock inventory and miscellaneous expenditures. Using 1969 Census of Agriculture data, each regional function was estimated using both OLS and ridge regression. As expected, parameter estimates under OLS were highly unstable due to multi-collinearity. One-third of the estimated coefficients took on nonsensical signs and the standard errors were generally high. For the ridge analysis, all parameter estimates, except one, took on the expected positive sign and the standard errors were decreased in every case. Returns to scale varied from a high of 1.200 in the Northwestern Ogallala to a low of .887 in the Lower Rio Grande Basin. From the fitted production functions, irrigation water demand was derived for alternative lengths run. Generally, water demand was found to be slightly elastic with the more elastic demand in the Desert Southwest and Upper Colorado Basin. Marginal irrigation water values were estimated for 1969 at the respective regional mean values of water usage, fixed input levels and variable input prices.
W79-05399

KENNEBEC RIVER CORRIDOR PLAN -- A MANAGEMENT PLAN FOR A REJUVENATED RESOURCE,
North Kennebec Regional Planning Commission, Winslow, ME.
E. L. Flynn, Jr.
September 1974. 100 p, 11 fig, 5 append. OWRT C-4297(No. 9047)(1), Vol.1.

Descriptors: *Water resources development, *River basin development, *Water resources management, *Maine, *Kennebec River, Water conservation, Long-term planning, Projections, Area redevelopment, Surveys, Social aspects, Regional development, Environmental effects, Ecology, Recreation, River basin commissions, Hydroelectric power, Wildlife, Habitats, Water policy, Comprehensive planning.

The Kennebec River Corridor Plan was drafted by Northern Kennebec River Planning Commision to maximize the potential for multiple use of land and water resources while minimizing destruction of the environment of the corridor. At present, the Kennebec River is a moderately developed, industrial watershed, managed primarily for maximum hydroelectric power generation. Despite this, much of the river shore is undeveloped, because heavy pollution and constant presence of logs have reduced its desirability for development. Two segments of the river were recommended for general recreational uses, the southern part of Wyman Lake and the pool behind Shawmut Dam in Fairfield. It is suggested that state, municipalities, or other authorities evaluate these areas for park facilities. Three areas were identified as having significant value for wildlife and low impact recreational use. Much of the undeveloped corridor consists of floodplains, steep slopes, assorted poor soils and significant wildlife areas, and, on this basis, is recommended to remain open. In addition, to a general analysis of the area, the plan divides the river into small, relatively homogeneous segments for more detailed analysis of natural resources and more precise management recommendation. Specific recommendations were made in each segment concerning areas such as historic sites, wildlife habitats, and significant physical features. Recommendations are aimed at landowners, local governments, and state agencies who will continue to manage the corridor. (See W79-05403 thru W79-05407) (Majtenyi-IPA)
W79-05402

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX I: DEMOGRAPHY,
North Kennebec Regional Planning Commission,

Winslow, ME.
E. L. Flynn, Jr.
May 1975. 31 p, 2 fig, 16 tab. OWRT C-4297(No. 9047)(1), (2).

Descriptors: *River basin development, *Kennebec River, *Water resources management, *Demography, *River basin commissions, Surveys, Projections, Long-term planning, Human populations, Project planning, Flood plains, Community development.

A demographic analysis was carried out to help in formulation of the North Kennebec River Corridor Project. The analysis was conducted primarily to outline the regional trends in population movement and housing development for the region's municipalities which are responsible for coping with population dynamics. It was also aimed at helping the Regional Planning Commission and other state and local organizations to identify problem areas or potential problem areas that may need special attention or assistance. Analysis indicated that the region is more populated with relatively old and young people rather than by middle aged people mainly because of lack of opportunity for middle aged wage earners. Also, young females are more abundant than young males who have left the region seeking better job opportunities. In recent decades, the area has been suburbanized both by people moving from urban areas and from rural fringe areas. Also, people tended to migrate to the lake communities. A moderate rate of growth is projected for the region, about 3% per decade, with much taking place near employment centers and near existing water and sewer systems. Lake development is expected to decline as the amount of vacant developable shoreland is used up. This may lead to more river front development but, because of limitations caused by low lying flood plains and wet lands and steep banks, the amount of this development is difficult to predict. (See also W79-05402) (Majtenyi-IPA)
W79-05403

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX II: WATER RESOURCES,
North Kennebec Regional Planning Commission, Winslow, ME.
E. L. Flynn, Jr.
May 1975. 56 p, 2 tab. OWRT C-4297 (No. 9047) (1), Vol. 3.

Descriptors: *River basin development, *Kennebec River, *Water resources management, *Water supply, *Water quality, Lakes, River basins, Groundwater, Water pollution, Watersheds(Basins), Watershed management, Water utilization, Water pollution control, Treatment facilities, Stream pollution, Groundwater resources, Evaluation, Projections, River basin commissions, Hydrologic data.

Evaluating data on the adequacy of supply and quality of the waters throughout the watershed was a major component of the Kennebec River Corridor Project. The focus was on correlating existing and needed water resources data to land use management. Data were analyzed concerning six aspects of the area's water resources: water supply, stream water quality, lake water quality, groundwater quality, pollution sources in the Kennebec River and tributaries, and future water quality. The following conclusions were reached: (1) the region's water supply is more than adequate to meet expected needs far into the future but water quality may require increased protection; (2) stream water quality is improving substantially throughout the watershed except in the upper Sebasticook River Valley; (3) deteriorating lake water quality is the region's most pressing water problem for which there is a considerable amount of data but few currently acceptable solutions; (4) groundwater quality remains an unknown entity, but may become a significant issue in the future; (5) all major point sources of pollution will be receiving some form of treatment by 1976 but the Sebasticook River watershed is woefully lacking in treatment facilities; (6) future water quality improvement in the Kennebec River will depend on decreasing pollution from non-point sources and improving existing treatment plant effectiveness by reducing storm water overloading. (See W79-05402) (Majtenyi-IPA)
W79-05404

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX III: FLOW REGULATION,
North Kennebec Regional Planning Commission, Winslow, ME.
E. L. Flynn, Jr., G. Bernstein, and D. Meagher.
March 1978. 12 p, 4 tab. OWRT C-4297(No. 9047)(1) Vol. 4.

Descriptors: *River basin development, *Kennebec River, *Flow control, *River flow, *Water supply, Dams, Hydroelectric power, Lakes, Water utilization, Natural resources, Water resources development, Water resources management, Evaluation, Safety factors, River basin commissions, Multiple purpose reservoirs, Project purposes.

Flow regulation of the Kennebec River was studied and analyzed and some of the issues related to flow regulation are introduced. Data of ten hydroelectric dams and 14 major storage reservoirs are tabulated. The Kennebec River has changed from a single use river, basically industrial, to one that can be used for multiple purposes since log drives were discontinued in 1976. Major impoundments on the Kennebec are regulated by the Kennebec Water Power Company according to a flow management plan and judgments based on years of experience by the river management company. The Maine Department of Inland Fish and Wildlife is currently satisfied with the balance achieved between maintenance of lake levels and river flow in the Kennebec basin. Many small dams have been abandoned by their original owners and are deteriorating, thereby posing a potential safety hazard. The following recommendations were made: (1) flow regulation of the Kennebec river should continue to consider multiple use when making management decisions; (2) future proposals for hydroelectric generating or pump storage facilities should be evaluated for their impact on the multiple use capacity of the river; and (3) safety standards for dams should be established and a system for maintaining and managing a dam should be developed involving those people who directly benefit from the particular dam. (See also W79-05402) (Majtenyi-IPA)
W79-05405

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX IV: FLOODING,
North Kennebec Regional Planning Commission, Winslow, ME.
E. L. Flynn, Jr., G. Berstein, and D. Meagher.
Revised, February 1978. 46 p, 7 fig, 5 tab, 2 append. OWRT C-4297(No. 9047)(1) Vol. 5.

Descriptors: *River basin development, *Flood control, *Kennebec River, *Flood protection, Water resources development, Flood plains, Rivers, Flood damage, Flood forecasting, Dams, Flood plain insurance, Mapping, Contours, Planning, Government supports, Governmental interrelations, Administration, Institutions, Monitoring, Water resources management, River basin commissions.

The problem of flooding in the Kennebec River corridor was investigated beginning with a history of flooding and the influence of basin characteristics and tributary flow on flood behavior along the mainstream. Damage is described and some projections for the future are made. Methods of delineating the expected area of inundation are illustrated and management tools for controlling development within this area are discussed. Although monitoring, issuing advisories and warnings, and exercising the little control afforded by hydroelectric dams have been the traditional means to control flooding, more effective management should involve controlling flow with existing multi-purpose dams and regulations of development within the floodplain itself. Problems to be solved include: (1) delineation of the actual floodplain which could be carried out by unifying the multitude of flood zones into a uniform zone that would apply in all regulatory and permit situations; (2) the multitude of requirements, standards, and procedures for local review imposed by Flood Insurance Programs and others which could be dealt with more efficiently with assistance from the regional planning commission in the form of model ordinances and review procedures, direct consultation, and workshops; and (3) the attidude of municipalities toward the state and Federal programs which they implement. It is recommended that the entire flood management program could be more equitably applied and smoothly administered if integrated into a comprehensive plan with town-wide zoning. (See also W79-05402) (Majtenyi-IPA)
W79-05406

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX V: MANAGEMENT PLAN,
North Kennebec Regional Planning Commission, Winslow, ME.
E. L. Flynn, Jr., G. Bernstein, and D. Meagher.
April 1977, revised by A. Cox, April 1978. 14 p. OWRT C-4297(No. 9047)(1) Vol. 6.

Descriptors: *River basin development, *River basin commissions, *Management, *Kennebec River, Water resources management, Flood plains, Aquifers, Scenery, Recreation, Water resources development, Land management, Comprehensive planning, Environmental effects, Environmental control, Rivers, River basins, Natural resources.

A management plan for the Kennebec River Corridor was designed to serve the dual purpose of discussing the alternative management options for the river corridor while providing a commentary on some of the land use management laws and techniques currently in use in Maine. The basic corridor management scheme requires: (1) acquiring title or interests of critical resources that deserve absolute public protection, such as valuable natural, scenic, historic, or recreational areas: (2) promoting proper resource management on privately owned land to enhance the multiple use value of the corridor; (3) utilizing effective land use regulations to protect fragile areas, such as flood plains, steep slopes, aquifers, and wetlands; and (4) guiding growth and development into most suitable and desirable areas. Before this plan can be carried out, an inventory of all corridor resources must be prepared so that evaluation is possible. Also, close contact with landowners is recognized as of great importance in success of the plan. The goal is to develop a landowner with an environmental conscience and the knowledge to utilize land resources with minimum adverse impacts. (See also W79-05402) (Majtenyi-IPA)
W79-05407

INTEGRATING WATER RESOURCES AND LAND USE PLANNING,
Utah Water Research Lab., Logan; and Utah Center for Water Resources Research, Logan.
J. Mulder, K. R. Kimball, D. T. Larson, L. D. James, and L. R. Rovig.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 643, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Planning Series UWRL/P-79-01, January 1979. 114 p, 11 fig, 9 tab, 2 append. OWRT C-6279(5227)(1). 14-34-0001-5227.

Descriptors: *Land use, *Planning, Model studies, Institutions.

Information and recommendations were developed pertaining to the integrating of water resource and land use planning at a conceptual level. In the accomplishment of this goal, the report acts as a vehicle of information transfer to facilitate recognition of the interrelationships between land use and water resources planning by practitioners in both areas. The approach that was used includes six basic components: (1) the clarification of current planning theory as it pertains to both water and land use planning, (2) analysis and review of historical and current land use planning practices, (3) analysis and review of historical and current water planning practices, (4) identification of problems and concepts which would affect the integration of

land and water planning, (5) the design of a conceptual framework (the IRUM model) which would facilitate the integration of land and water planning, and (6) a case study of a selected planning region for small scale applications of the IRUM model. In connection with the case study, a general population survey was taken to identify social and environmental values, land and water use preferences, and other conditions which would affect an integrated planning effort. The recommendations cover institutional issues such as culture, law, and organizational arrangements, and also methodological issues such as conceptual framework development and procedural problems which will confront actual efforts to integrate land and water resource planning.
W79-05408

CONNECTICUT RIVER DIVERSION: A CASE STUDY IN WATER ALLOCATION POLICY,
Massachusetts Univ., Amherst. Water Resources Research Center.
E. R. Kaynor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 785, Price codes: A11 in paper copy, A01 in microfiche. Publication No. 98, 1978. 175 p, 16 tab, 170 ref, 4 append. OWWR C-7178 (No. 6215) (2), 14-34-0001-6215.

Descriptors: *Connecticut River, *Diversion, *Water allocation, Inter-basin transfers, Planning, Water policy.

Water allocation problems in the Northeast were investigated using current plans for interbasin transfers from the Connecticut River Basin as a topical focus. It was found that what appeared to be political controversy between areas of water export and import was, in reality, due mainly to absence of answers to key planning questions and to inconsistent data used to support diversion plans. Existing democratic institutions, while less than ideal, would be adequate to set allocation policy and to implement rational allocation plans if a means could be found to improve planning and data acquisition. A planning format featuring advocacy planning by protagonists moderated by impartial professionals is suggested. (Godfrey-Mass)
W79-05414

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

DISTRIBUTING REGIONAL SERVICES COSTS,
Environmental Protection Agency, Cincinnati, OH.
L. A. Rossman, and P. A. Graham.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. UP1, p 51-62, January 1979. 1 fig, 2 tab, 17 ref.

Descriptors: *Cost analysis, *Cost distribution, *Regional planning, *Services, Water resources, Game theory, Linear programming, Optimization, Constraints, Equity maximization, Stability maximization, Cost minimization, Equations, Systems analysis.

Regional systems to provide urban services must be designed not only on the basis of cost effectiveness but also with regard to a proper distribution of costs among the participants. The cost distribution should be equitable and stable (in the sense that incentives for groups to break away and form separate systems are minimized). Concepts of n-person cooperative game theory are utilized to develop quantitative measures of equity and stability. These measures are incorporated into linear programming models that allow explicit equity-stability tradeoffs to be made in distributing the costs of the least-cost regional service plan. Examples that demonstrate the use of the methods are provided. (Bell-Graf--Cornell)
W79-05276

THE GERMAN FEDERAL LAW ON WASTEWATER CHARGES,
Technische Univ., Darmstadt (Germany, F.R.).
For primary bibliographic entry see Field 6E.
W79-05315

A MODEL FOR COST OPTIMIZATION OF BARGE SHIPMENTS,
Missouri Univ.-Rolla. School of Engineering.
W. A. Brooks, H. E. Metzner, and M. L. Smith, Jr.
Transportation Journal, Vol. 18, No. 1, p 36-44, 1978. 2 fig, 8 tab, 7 ref.

Descriptors: *Barges, *Costs, *Optimization, *Computer models, *Dedicated towing service, *General towing service, *Cost analysis, Shipping, Transportation, Model studies, Inland waterways, Linehaul costs, Terminal costs, Ownership costs.

A computer model minimizes barge costs incurred by shippers on the inland waterway system, including linehaul costs, terminal costs at origin and destination, cargo insurance, and inventory expenses. Linehaul costs are calculated in a unique way for both dedicated and general towing service. The model comprises four basic calculations: (1) transit/terminal and interchange times, (2) costs for each towing service, (3) barge ownership costs, and (4) miscellaneous shipping costs. Calculations for each type of towing service are repeated for each cost analysis. An illustration of the use of the model is exemplified with two movements of liquid styrene from Houston, Texas, to Cincinnati, Ohio; the amount of tonnage is varied while holding constant other cost factors, including barge type and capacity, terminal times, and reshipping at the destination. Conclusions: (1) at higher volume, dedicated towing service generally offers reduced barge ownership and towing costs on a distributed basis (per net ton), plus faster and more uniform round trip times; (2) at lower volume, general towing service should be used; and (3) a total barge-incurred cost curve should be constructed for varying amounts of tonnage in the general range of anticipated tonnage. The mode may also be applied to trucking and railway shipping. (Lynch-Wisconsin)
W79-05317

6D. Water Demand

DETECTION OF ENTEROVIRUSES AND BACTERIAL PATHOGENS SURVIVING STANDARD SEWAGE TREATMENT,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W79-05090

PRELIMINARY APPLICATIONS OF LANDSAT IMAGES AND AERIAL PHOTOGRAPHY FOR DETERMINING LAND-USE, GEOLOGIC AND HYDROLOGIC CHARACTERISTICS--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.; and Geological Survey, Sioux Falls, SD. Water Resources Div.
For primary bibliographic entry see Field 7B.
W79-05163

A WATER DEMAND AND WASTEWATER DISPOSAL MODEL FOR OPTIMUM TRANSFER OF WATER RESOURCES TECHNOLOGY IN DEVELOPING COUNTRIES,
Federal Univ. of Paraiba, Campina Grande (Brazil). Dept. of Civil Engineering.
M. I. Muiga, and G. W. Reid.
In: Water Knowledge Transfer. Volume 2, Proceedings of the Second International Conference on Transfer of Water Resources Knowledge, June 1977, Fort Collins Colorado. N.S. Grigg, et al., Ed., Water Resources Publications, Fort Collins, Col., 1978, p 1000-1016. 3 fig, 7 tab, 20 ref.

Descriptors: *Water demand, *Waste water disposal, *Forecasting, *Data analysis, *Stepwise multiple regression, Water resources, *Developing countries, Municipal water, Costs, Statistical methods, Analytical techniques, Sewage, Estimating, Equations, Mathematical models, Systems analysis, Socio-economic conditions, Technology indicator, Optimum transfer.

This paper provides engineers, planners, and appropriate public officials in developing countries with innovative techniques for more effective methods of predicting municipal water demands and wastewater disposal in these countries. The forecasting equations developed can be used to project municipal water demand and wastewater discharged with a reasonable degree of reliability, rather than directly applying data from industrial nations to developing countries. Used are mathematical modeling techniques to derive predictive equations for municipal water demand and wastewater disposal models utilizing socio-economic, environmental, and technological indicators. Predictive equations are developed for each of the three regions of Africa, Asia, and Latin America. Data analysis indicates municipal water demand is a function of population, income, and a technology indicator (percentage of households connected to the water supply systems or having piped water). Shown is a weak association of demand to the price of water to the consumers. In the analysis, the amount of waste water increases daily with the increase of per capita consumption of water and with the increase of the wastewater disposal system, while in-house waste disposal processes show a decrease in per capita wastewater disposed daily. (See also W79-05409) (Bell-Cornell)
W79-05413

SURVEY ON SESAYAP RIVER AS POSSIBLE WATER RESOURCE FOR A PULP AND PAPER MILL (IN INDONESIA) (SURVAI SUNGAI SESAYAP DAN KEMUNGKINANNYA SEBAGAI SUMBER AIR UNTRK PABRIK PULP DAN KERTAS),
Berita Selulosa, Vol. 14, No. 1, p. 1-7, March, 1978. 2 illus, 3 ref, 3 tab. English summary.

Descriptors: *Pulp and paper industry, *Water supply, *Indonesia, Water, Sites, Saline water, Water resources, Sesayap River(Indonesia), Indonesia.

Based on water samples taken over two months along the Sesayap River, various possible sites for a new pulp and paper mill in East Kalimantan Province are discussed, along with some water supply problems, such as salt water boundaries. (Brown-IPC)
W79-05427

ABSOLUTE SOLUTION TO INDUSTRIAL WASTE WATER PROBLEM--OUTFALL PREVENTION (DIE ABSOLUTE LOESUNG DES INDUSTRIEABWASSER--PROBLEMS -- UNTERBINDUNG DES ABFLUSSES),
For primary bibliographic entry see Field 3E.
W79-05433

6E. Water Law and Institutions

INSTITUTIONAL ARRANGEMENTS FOR EFFECTIVE WATER MANAGEMENT IN COLORADO,
Colorado State University, Fort Collins, CO. Dept. of Political Science.
P. O. Foss.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 647, Price codes: A11 in paper copy, A01 in microfiche. Water Resources Research Institute. Colorado State University, Completion Report, November, 1978. 232 p, 121 ref. OWRT A-029-COLO(2). 14-34-001-6006.

Descriptors: *Water supply, *Institutions, *Political aspects, *Legal aspects, Governments, Competing uses, Legislation, Planning, Intergovernmental relations, Colorado, Rocky Mountain States.

Rapidly increasing population and industrial growth in Colorado have sharply increased demands for water. In the face of these increasing demands, water supply is relatively fixed. Present occasional or isolated shortages will soon become chronic. The study attempts to develop politically acceptable institutional arrangements for increasing the supply and for more efficient methods of utilizing present supplies. Among the options for increasing supply are: reevaluation of Colorado's commitments to downstream states; construction of additional storage developments with state funds or consortiums of sub-state units; increased state support for precipitation augmentation; increased state support for watershed management; increased ground water withdrawals; and an expeditious resolution of Federal Reserved Rights and Indian claims. Options for increasing efficiency of present supply by institutional methods include: discourage population growth; integrate land and water planning; employ the zoning concept to regulate water use; integrate water quantity and water quality management in the same agency; integrate ground and surface water management; encourage conservation methods in irrigation and municipal use; facilitate temporary transfers including a state 'water bank;' integrate management of all water supply units in a single state water board.
W79-05049

THE GERMAN FEDERAL LAW ON WASTEWATER CHARGES,
Technische Univ., Darmstadt (Germany, F.R.).
G. Rincke.
Progress in Water Technology, Vol. 10, No. 3-4, p 95-102, 1978. 3 fig, 20 ref.

Descriptors: *Pollution taxes(Charges), *Economics, *West Germany, *Water pollution control, *Regulation, *Legal aspects, *Legislation, Water quality standards, Effluent limitations, Effluents, Waste water disposal, Political constraints, Permits, Economic efficiency, Damages, Marginal costs, River basin commissions, Incentives, Motivation.

Potential effects of West Germany's 1976 water pollution control law which incorporates effluent charges are analyzed. Extended political debate resulted in several compromises in the law and effluent charges consequently form only part of a combined system of incentives along with regulations and regional planning. Various pollution control methods are reviewed, including effluent standards or regulations; moral and political pressure; liability for damages; fines; subsidies, loans, or tax remissions; river basin associations; and economic inventives through effluent charges and marketable effluent permits. The law provides for assessment of charges to begin in 1981 instead of 1976 as in an earlier draft, and to reach the full rate of 40 DM (capital and operation costs)/SE (damage equivalents) by 1986. The 'polluter pays' principle was not realized, and some exceptions decrease the effect of efficiency standards. Pollution damage equivalents (SE) are determined on the basis of several parameters: (1) suspended solids with an organic portion 10% or greater (1 SE/cu m/a); (2) suspended solids with an organic portion less than 10% (0.1 SE/cu m/a); (3) organic matter in the settled sample (2.2 SE/100 kg COD/a); (0.3 SE.G sub F/1000 cu m/a). G sub F is the point of dilution at which wastewater is no longer toxic to the fish Leuciscus melanotus. (Lynch-Wisconsin)
W79-05315

KENNEBEC RIVER CORRIDOR PLAN -- A MANAGEMENT PLAN FOR A REJUVENATED RESOURCE,
North Kennebec Regional Planning Commission, Winslow, ME.
For primary bibliographic entry see Field 6B.
W79-05402

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX I: DEMOGRAPHY,
North Kennebec Regional Planning Commission, Winslow, ME.
For primary bibliographic entry see Field 6B.
W79-05403

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX II: WATER RESOURCES,
North Kennebec Regional Planning Commission, Winslow, ME.
For primary bibliographic entry see Field 6B.
W79-05404

KENNEBEC RIVER CORRIDOR PROJECT -- APPENDIX V: MANAGEMENT PLAN,
North Kennebec Regional Planning Commission, Winslow, ME.
For primary bibliographic entry see Field 6B.
W79-05407

CONNECTICUT RIVER DIVERSION: A CASE STUDY IN WATER ALLOCATION POLICY,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 6B.
W79-05414

THE LAW OF SURFACE WATER ALLOCATION IN GEORGIA,
Georgia Univ., Athens. Inst. of Natural Resources.
J. O. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 634, Price codes: A05 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Atlanta. Report No. ERC 05-78, September 1978, 82 p., OWRT A-072-GA(1), 14-34-0001-7022.

Descriptors: Riparian rights, Diversion, *Water rights, Inter-basin transfer, *Water allocation, Reservoirs.

Predicted water supply shortages and other water problems in the Atlanta metropolitan area gave impetus recently to studies undertaken at the direction of federal and state congressional resolutions. All of the proposed alternative solutions raise one or several common legal issues. In 1977, the Georgia General Assembly enacted amendments to the Water Quality Control Act to allow the Environmental Protection Division to control some uses of surface waters through a permit program. The provisions of the amendments in most instances carefully avoid clearly unconstitutional divestments of water rights. However, in the areas of transbasin diversion of water and use of water on non-riparian lands, the amending statute creates as many uncertainties as it was intended to resolve. Federal reservoirs are a significant potential source of high-quality water supplies. Federal authority exists to support allocation of some of these waters by reservoir managers without prior congressional authorization. However, major water allocations from such federal impoundments will require reauthorization by Congress. In either case, such allocations by federal authority will have to be consistent with state law.
W79-05415

6F. Nonstructural Alternatives

PLAN OF STUDY: CASE STUDIES OF THE APPLICATION OF COST SHARING POLICY OPTIONS FOR FLOOD PLAIN MANAGEMENT IN THE CONNECTICUT RIVER BASIN.
New England River Basins Commission, Hanover, NH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 386, Price codes: A07 in paper copy, A01 in microfiche. September 8, 1977. 118 p. OWRT IA-TQ-3.

Descriptors: *Flood control, *Non-structural alternatives, *Cost sharing, Water Resources Development Act, Flood plain management, Water resources planning, Connecticut River, Institutions, Flood proofing.

This document describes a Plan of Study for the conduct of special flood plain management and institutional studies to be carried out by the New England River Basins Commission, pursuant to Section 73(b) of the Water Resources Development Act of 1974, P.L. 93-251. This act authorizes federal cost sharing of 80 percent or more for nonstructural flood plain management measures such as relocation, flood proofing, flood plain regulation and open land acquisition. Its implementation has been held up to permit the Water Resources Council and its member agencies to examine its financial and institutional implications and, on the basis of this examination, to propose policies, procedures, terms and conditions under which federal funding will be authorized under the act. The 'Section 73' study will consider and make recommendations to the Council and basin states on how to secure implementation of federal cost sharing for nonstructural flood plain management studies under Section 73; and to assist the agencies in the formulation, evaluation and selection of cost sharing alignments and institutional arrangements needed to implement flood plain management programs.
W79-05232

FLOOD-PLAIN MANAGEMENT IN DALLAS, TEX.: 1908-1978,
Dallas Dept. of Public Works, TX.
M. McCorkle, and A. H. Halff.
Journal of the Hydraulics Division, Vol. 105, No. HY2, p. 125-137, February 1979. Proceedings of the American Society of Civil Engineers. 1 fig, 3 tab, 7 ref.

Descriptors: *Flood control, *Land reclamation, *Municipal engineering, *Floodways, *Flood plains, Regulation, Hydraulics, Hydrology, Land use, Storm sewers, Water management(Applied), Nonstructural alternatives, Structural approaches.

Dallas, Texas has faced serious flooding problems due to rapid urbanization and encroachment upon flood plains. The city's flood-plain management has relied on both nonstructural and structural approaches to flood-loss prevention. The overall program emphasizes: (1) careful deliniation; (2) an individualized response to each drainage basin; (3) multipurpose use of reclaimed and preserved flood plains; (4) public ownership of land reserved for flood-water conveyance; and (5) flood-plain management that maximizes visual environmental qualities. (Bell-Graf--Cornell)
W79-05272

6G. Ecologic Impact Of Water Development

COASTAL MORPHOLOGY, OIL SPILL VULNERABILITY AND SEDIMENTOLOGY OF KOTZEBUE SOUND AND KODIAK ISLAND,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-05213

THE EFFECTS OF OIL ON TEMPERATURE REGULATION IN SEA OTTERS,
Scripps Institution of Oceanography, La Jolla, CA. Physiological Research Lab.
For primary bibliographic entry see Field 5C.
W79-05214

SUBLETHAL EFFECTS OF PETROLEUM HYDROCARBONS AND TRACE METALS, INCLUDING BIOTRANSFORMATIONS, AS REFLECTED BY MORPHOLOGICAL, CHEMICAL, PHYSIOLOGICAL, PATHOLOGICAL AND BEHAVIORAL INDICES,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5C.
W79-05216

MITIGATING ADVERSE ENVIRONMENTAL EFFECTS OF HIGHWAY CONSTRUCTION.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-247 737, Price codes: A03 in paper copy, A01 in microfiche. Transportation Research Record 551, 1975. 42 p. Transportation Research Board, National Research Council, National Academy of Sciences, Washington, DC. Wilburn, M.C., editor.

Descriptors: *Highways, *Environmental effects, *Erosion, *On-site investigations, Road construction, Landscaping, Highway beautification, Grasses, Pollutants, Silts, Lakes, Recreation, Sedimentation, Erosion control, Construction, Vegetation, Land use, Social aspects, Social impact, Vegetation establishment, Cities, Rural areas, Institutions, Organizations.

The 4 papers in this report indicated the wide range of disciplines and interests that are involved in the roadside environmental aspects of highway construction. The subject areas covered and related to water resources included interdisciplinary team approach to mitigating adverse environmental impacts of highway construction, silt barriers as erosion pollution control in a large recreational lake, and better grasses for roadsides. (See also W79-05236 thru W79-05238) (Humphreys-ISWS)
W79-05235

INTERDISCIPLINARY TEAM APPROACH TO MITIGATING ADVERSE ENVIRONMENTAL IMPACTS OF HIGHWAY CONSTRUCTION,
Federal Highway Administration, Sacramento, CA. California Div.
J. R. Gordon.
In: Mitigating Adverse Environmental Effects of Highway Construction; Transportation Research Record 551, p 1-11, 1975. 8 fig, 1 tab.

Descriptors: *Highways, *Environmental effects, *California, *Planning, *Organizations, Institutions, Management, On-site investigations, Wildlife habitats, Vegetation, Dunes, Marshes, Ponds, Mitigation, Interdisciplinary team.

To assess the effectiveness of the interdisciplinary team approach in highway planning and project development in California, the author, by using the case study method, examined the interrelationships and interworkings of engineering and nonengineering skills in addressing problems associated with the impact of highway construction on the sensitive natural environment within the jurisdiction of the Coastal Zone Conservation Commission. As a result of this analysis, it was concluded that agency organizations should provide for an in-house core of expertise and use outside consultants only when highly specialized expertise is needed. Also, the organization must be flexible so that the concept can be applied easily at all stages of the highway planning and project development process. Of importance to the successful operation of the interdisciplinary team approach is the attitude of top management. It must be responsive to issues raised by all disciplines and must consider the contributions of all disciplines equally and fairly. Through the implementation of the California Action Plan, California has committed itself to the effective application of the interdisciplinary team approach. (See also W79-05235) (Humphreys-ISWS)
W79-05236

BETTER GRASSES FOR ROADSIDES,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Soils and Crops.
R. W. Duell, and R. M. Schmit.
In: Mitigating Adverse Environmental Effect of Highway Construction; Transportation Research Record 551, p 30-41, 1975. 8 fig, 13 tab, 4 ref.

Descriptors: *Highways, *Vegetation establishment, *Grasses, *New Jersey, Environmental effects, Landscaping, Bank protection, Slope protection, Roadbanks, Highway beautification, On-site tests, Land use, Bluegrasses, Fescues.

The growing importance of maintenance costs and environmental aesthetics dictates the need to develop better roadside grasses. More than a thousand varieties or strains of 36 species were established in 4 sq yd plots along 8 roadsides throughout New Jersey and 3 experiment station sites over 5 years. Coarse grasses, including Kentucky 31 tall fescue and redtop, consistently produced conspicuous, persistent seed heads that detract from the appearance of the grassy landscape. Finer turf grasses, including certain varieties of Kentucky bluegrasses and 4 fine fescues, established readily and produced fewer and less objectionable seed stalks. Perennial ryegrass varieties initially produced an abundance of foliage and seed stalks, excessively crowded associated grasses, and disappeared after 2 years of low-intensity management. Outstanding performance of spreading fine fescues at several locations prompted the development of a new variety, Fortress, synthesized from locally collected elite plants. The importance of seed-free mulch was shown. It appears inappropriate to try to keep down vigorous species with frequent mowing or to tolerate their coarse appearance when unmowed. Better appearance with less mowing can be achieved with properly established mixtures of superior varieties of fine fescues and Kentucky bluegrasses. (See also W79-05235) (Humphreys-ISWS)
W79-05238

ECOLOGICAL OBSERVATION ON THE ADULT SALMON: I. DIURNAL VARIATION OF UPSTREAM MIGRATION OF THE ADULT CHUM SALMON IN THE CHITOSE RIVER (IN JAPANESE),
Hokkaido Salmon Hatchery, Sapporo (Japan).
H. Mayama, and T. Takahashi.
Sci Rep Hokkaido Salmon Hatchery 31. p 21-18. 1977. (English summary).

Descriptors: *Salmon, *Fish migration, *Powerlants, Japan, Streamflow.

Diurnal variation of upstream migration of the adult chum salmon (Oncorhynchus keta) was observed at the Nishikoshi (Japan) catching station of the Chitose River, a tributary of the Ishikari River, during Oct. in 1974 and in 1975. Upstream activity occurred principally in daytime. A major factor controlling upstream movement was the fluctuation in the amount of water discharged from power plants located on the upper river. Copyright 1978, Biological Abstracts, Inc.
W79-05348

7. RESOURCES DATA

7A. Network Design

EVALUATION AND DESIGN OF A STREAMFLOW-DATA NETWORK IN WASHINGTON,
Geological Survey, Reston, VA. Water Resources Div., and Geological Survey, Tacoma, WA. Water Resources Div.
M. E. Moss, and W. L. Haushild.
Geological Survey open-file report 78-167, 1978. 43 p, 7 fig, 1 plate, 7 tab, 15 ref.

Descriptors: *Streamflow, *Network design, *Washington, *Model studies, *Regional analysis, Regression analysis, Average flow, Floods, Peak discharge, Flood forecasting, Flood frequency.

A network-design technique developed by Moss and Karlinger (1974) is described and applied in the evaluation and design of a streamflow-data network in Washington State. The technique evaluates the changes in the accuracy of regionalization models that result from changes in lengths of periods of record, or number of stations. The regionalization models for natural-flow streams in Washington are the regression equations for means and standard deviations of the annual mean-flow and peak-flow series and floods with exceedance probabilities of 2 percent. The net work-design analyses indicate that relatively little improvement in the accuracy of estimation at streamflow data--neither in terms of added record length nor added streamflow stations. (Woodard-USGS)
W79-05159

7B. Data Acquisition

THE WORLD REMOTE SENSING INDEX, A COMPREHENSIVE GEOGRAPHIC INDEX BIBLIOGRAPHY TO REMOTE SENSING SITE INVESTIGATIONS OF NATURAL AND AGRICULTURAL RESOURCES THROUGHOUT THE WORLD,
December 1976. 631 p. P. F. Krumpe, Compiler. Tensor Industries, Inc., Fairfax, Virginia.

Descriptors: *Bibliographies, *Remote sensing, *Geographical regions, Natural resources, Land resources, Agriculture, On-site investigations, Indexing, Documentation, Resources, Abstracts, Publications, Forestry, Environment, Soils, Hydrology, Water management(Applied), Oceangraphy, Mapping, Geographic index, Marine ecology.

This volume is a geographic index bibliography of over 4,000 references on remote sensing of natural and agricultural resources throughout the world. Citations from 1970 to August 1976 were arranged within 14 major disciplines among more than 150 geographic areas, states, and countries. This extensive compilation originated from more than 850 foreign and domestic sources among six major publishing categories. Instructions for procuring desired publications or reports were included in addition to guidelines for efficient utilization of the document. This book was designed as an integrated reference guide for use in remote sensing and environmental education, training, applications research, analysis, and technology transfer. (Froehlich-ISWS)
W79-05119

PREDICTION OF SOIL LOSS ON CROPLAND WITH REMOTE SENSING,
Texas Christian Univ., Fort Worth. Dept. of Geology.
K. M. Morgan, G. B. Lee, R. W. Kiefer, T. C. Daniel, and G. D. Bubenzer.
Journal of Soil and Water Conservation, Vol. 13, No. 6, p 291-293, November-December 1978. 1 fig, 2 tab, 24 ref.

Descriptors: *Remote sensing, *Soil erosion, *Land use, *Wisconsin, Crops, Aerial photography, Watersheds(Basins), Agricultural watersheds, Erosion, Sediments, Erosion control, Water quality, Data processing, Agriculture, Universal soil loss equation, Soil loss.

High-altitude color and color infrared photography were used in conjunction with the universal soil loss equation to predict inter-rill and rill erosion on cropland in three Dane County, Wisconsin, watersheds with varying soils, topography, and land use. Soil loss predictions based on remote-sensing interpretations agreed closely with predictions based on field studies. (Sims-ISWS)
W79-05148

PRELIMINARY APPLICATIONS OF LANDSAT IMAGES AND AERIAL PHOTOGRAPHY FOR DETERMINING LAND-USE, GEOLOGIC AND HYDROLOGIC CHARACTERISTICS--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.; and Geological Survey, Sioux Falls, SD. Water Resources Div.
F. J. Heimes, G. K. Moore, and T. D. Steele.
Geological Survey Water-Resources Investigations 78-96 (open-file report), October 1978. 48 p, 19 fig, 7 tab, 18 ref.

Descriptors: *Land use, *Aerial photography, *Satellites(Artificial), *Remote sensing, *River basin development, Water demand, Land classification, On-site investigations, Regional analysis, Arid lands, Colorado, Wyoming, *Yampa River basin, *Upper Colorado River basin, *LANDSAT.

Expanded energy- and recreation-related activities in the Yampa River basin, Colorado and Wyoming, have caused a rapid increase in economic

development which will result in increased demand and competition for natural resources. In planning for efficient allocation of the basin's natural resources, Landsat images and small-scale color and color-infrared photographs were used for selected geologic, hydrologic and land-use applications within the Yampa River basin. Applications of Landsat data included: (1) regional land-use classification and mapping, (2) lineament mapping, and (3) areal snow-cover mapping. Results from the Landsat investigations indicated that: (1) Landsat land-use classification maps, at a regional level, compared favorably with areal land-use patterns that were defined from available ground information, (2) lineaments were mapped in sufficient detail using recently developed techniques for interpreting aerial photographs, (3) snow cover generally could be mapped for large areas with the exception of some densely forested areas of the basin and areas having a large percentage of winter-season cloud cover. Aerial photographs were used for estimation of turbidity for eight stream locations in the basin. Spectral reflectance values obtained by digitizing photographs were compared with measured turbidity values. Results showed strong correlations (variances explained of greater than 90 percent) between spectral reflectance obtained from color photographs and measured turbidity values. (Woodard-USGS)
W79-05163

ACOUSTIC MONITORING OF INDUSTRIAL CHEMICAL WASTE RELEASE AT DEEP WATER DUMP SITE 106,
Woods Hole Oceanographic Institution, MA. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 5B.
W79-05264

CONTROL OF OIL POLLUTION BY REMOTE SENSING ALONG THE SHORES OF FRANCE,
French Embassy, Washington, DC.
J-C. Mourlon.
In: Proceedings of the Twelfth Symposium on Remote Sensing of Environment, held in Manila, Philippines, 20-26 April 1978. Environmental Research Institute of Michigan, Ann Arbor, 1978. Vol. 1, p. 235-238.

Descriptors: *Oil spills, *Oil pollution, *Remote sensing, *Pollutant identification, Water pollution control, Path of pollutants, *Outer Continental Shelf, *France, Infrared radiometry, Airborne equipment.

Several countries, including France, have developed remote sensors that can be used aboard surveillance aircraft to detect and identify polluters. After several years of basic research, experimentation, and technological optimization, remote sensing by infrared radiometry using equipment developed by the 'Societe Anonyme de Telecommunications' (SAT) for the collection and transmission of data, was chosen as a means of controlling oil discharges and spills at sea. This report describes the organization of surveillance campaigns and the aerial, airborn and ground equipment used. During the first two campaigns a number of significant oil discharges were recorded, nine of which were judged sufficiently large to be further investigated. It is felt that if these campaigns are repeated regularly, they should have a dissuasive effect. (Sinha-OEIS)
W79-05392

REMOTE SENSING FOR OIL POLLUTION CONTROL ALONG COASTAL WATERS OF THE UNITED STATES,
Coast Guard Research and Development Center, Groton, CT.
J. White, and L. R. Breslau.
In: Proceedings of the Twelfth International Symposium on Remote Sensing of Environment, held in Manila, Philippines, 20-26 April 1978. Environmental Research Institute of Michigan, Ann Arbor, 1978. Vol. 1, p 239-255, 10 fig, 8 ref.

Descriptors: *Oil pollution, *Water pollution control, *Monitoring, *Remote sensing, Aircraft, Oil spills, Pollution abatement, United States, *Outer Continental Shelf, Airborne sensors, U.S. Coast Guard.

The Coast Guard has specific responsibilities for responding to and coordinating activities associated with pollutant spills that occur in the coastal area including ports, harbors and other waters on which ocean going vessels operate as well as adjacent high seas areas. The Coast Guard has successfully developed an operational airborne surveillance system and is currently conducting routine surveillance patrols with the system called 'Airborne Oil Surveillance System-II' (AOSS-II) which evolved from predecessor systems called the 'Airborne Remote Sensing System' (ARRS) and the 'Airborne Oil Surveillance System-I' (AOSS-I). The currently operational AOSS-II system is destined to be superseded by a system currently under development called the 'Airborne Remote Instrumentation System' (AIREYE). All of these systems are described. (Sinha - OEIS)
W79-05393

REMOTE SENSING OF THE OCEANS - A REVIEW,
Aircraft Research and Development Unit, Edinburgh (Australia).
G. A. Morgan.
In: Proceedings of the Twelfth International Symposium on Remote Sensing of Environment, held in Manila, Philippines, 20-26 April 1978. Environmental Research Institute of Michigan, Ann Arbor, 1978. Vol. 1, p. 599-617, 7 fig, 6 tab, 66 ref.

Descriptors: *Remote sensing, *Monitoring, *Pollution abatement, Water pollution control, Oil pollution, Satellites(Artificial), Outer Continental Shelf, SEASAT-A.

With the imminent launching of SEASAT-A an historical perspective of events leading up to this pioneering development is given and the evolution of current spacecraft having ocean sensing capabilities is outlined. Applications of remote sensing of the oceans from space are described including some in the Australian region. The continuing role of man in space as an observer of the oceans is illustrated by a discussion of likely future developments in the SHUTTLE/SPACELAB era. (Sinha-OEIS)
W79-05394

IMAGE ENHANCEMENT OF SIDE-SCAN SONAR MAPPING,
California Univ., Santa Barbara.
B. P. Luyendyk, E. J. Hajic, and D. S. Simonett.
In: Proceedings of the Twelfth International Symposium on Remote Sensing of Environment, held in Manila, Philippines, 20-26 April 1978. Environmental Research Institute of Michigan, Ann Arbor, 1978. Vol. 2, p. 1025-1026.

Descriptors: *Remote sensing, *Mapping, *Hazards, *Water pollution control, Resources development, Oil and gas, Geology, California, Outer Continental Shelf, Side-scan sonar.

The Santa Barbara Channel is typical of many border lands in that information on environmental geology is needed to provide citizens, industry and government with a realistic and accurate estimate of the geologic hazards affecting present and future resource development in coastal areas (oil and gas, fisheries, mining). For example, at the present time many offshore oil installations, including the world's deepest water platform (in construction), are located in the fault-laced Santa Barbara Channel. Existing geophysical information such as seismic reflection profiles, provide data mostly on older faults in deeper sub-bottom layers of the Channel. Side-scan sonar surveys will provide unique information on the character and stability of the sea bed itself. Side-scan sonar mapping allows a broad swath of seafloor textural information to be obtained in a short period of time and fault scarps, cracks, outcrops, sand waves, dunes, and ripples can be recognized. (Sinha-OEIS)
W79-05395

THE USE OF LANDSAT IMAGERY FOR MARINE POLLUTION STUDIES,
Singapore Univ.
Y. J. Chong.
In: Proceedings of the Twelfth International Symposium on Remote Sensing of Environment, held in Manila, Philippines, 20-26 April 1978. Environmental Research Institute of Michigan, Ann Arbor, 1978. Vol. 3, p 1741-1742.

Descriptors: *Remote sensing, *Resources development, *Monitoring, *Water pollution control, Environmental effects, Baseline studies, Coasts, *Outer Continental Shelf, Landsat imagery, Southeast Asia, Environmental impact.

A Landsat scene of the southernmost tip of the Asian mainland covers not only a very busy international waterway, the Straits of Singapore/Malacca, connecting the Pacific Ocean with the Indian Ocean, but also land areas of three countries where intense developments are being carried out. Remote sensing can play a useful role in supplementing the numerous ground level environmental studies. This presentation concerns the use of Landsat data to: obtain a precision image data base upon which overlays may be made to study the changes taking place; and provide a synoptic view of the region indicating how developments in one area can possibly influence marine pollution in the coastal zones of another area. (Sinha-OEIS)
W79-05396

7C. Evaluation, Processing and Publication

THE SEYMOUR AQUIFER GROUND-WATER QUALITY AND AVAILABILITY IN HASKELL AND KNOX COUNTIES, TEXAS, VOLUME I.
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W79-05014

THE SEYMOUR AQUIFER GROUND-WATER QUALITY AND AVAILABILITY IN HASKELL AND KNOX COUNTIES, TEXAS, VOLUME II.
Texas Dept. of Water Resources, Austin.
Report 226, December 1978. 265 p, 16 fig, 23 tab.

Descriptors: *Data collections, *Groundwater resources, *Texas, *Aquifers, *Water quality, *Chemical analysis, Well data, Water wells, Drillers logs, Groundwater availability, Brine disposal, Water pollution sources, Water levels, Hardness(Water), Dissolved solids, Sieve analysis, Particle size, Sulfates, Chlorides, Nitrates, Oil wells, *Haskell County(TX), *Knox County(TX), *Seymour aquifer.

This report was prepared in two volumes. Volume I described the quality and availability of the groundwater resources of the Seymour aquifer. It contained text and related illustrations and tables. Volume II contained supporting basic data consisting of maps and tables including: 15 well location maps; records of 2,058 water wells; records of water levels in 93 wells; results of chemical analyses of 2,197 water samples plus 11 tables containing results of over 200 additional chemical analyses on various specialized samples; 240 drillers' logs; descriptions of geologic samples from 16 surface localities and 4 wells; results of sieve analyses of formation samples; a cross-index of previously published well numbers; a list of available aerial photographs; and information on the production and disposal of oil field brines. (See also W79-05014) (Humphreys-ISWS)
W79-05015

FLUVIAL PROCESSES AND FACIES SEQUENCES IN THE SANDY BRAIDED SOUTH SASKATCHEWAN RIVER, CANADA,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2J.
W79-05135

ANNUAL SUMMARY OF GROUND-WATER CONDITIONS IN ARIZONA, SPRING 1977 TO SPRING 1978,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-05151

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--MISSOURI BASIN REGION,
Geological Survey, Lakewood, CO. Water Resources Div.
O. J. Taylor.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.00. Geological Survey Professional paper 813-Q, 1978. 41 p, 12 fig, 3 plates, 8 tab, 53 ref.

Descriptors: *Groundwater resources, *Regional analysis, *Missouri River, *Water supply, *Aquifer characteristics, Water quality, Withdrawal, Water yield, Hydrology, Groundwater recharge, Water utilization, Water reuse, Aquifer management, Surface-groundwater relationships, Groundwater availability, *Missouri Basin Region, Summary appraisals.

The Missouri Basin Region, about one-sixth of the contiguous United States, utilizes large water supplies for irrigation, industrial, public supply, and rural use. Groundwater resources occur in sand and gravel alluvium, glacial deposits, dune sand, basinfill deposits of sand and gravel, sandstone, siltstone, fractured sandy clay, limestone, and dolomite. Ground water is undeveloped in many areas. Unconsolidated and semiconsolidated aquifers have potential for conjunctive use with surface water, reuse of available supplies, artificial recharge, and salvage of evapotranspiration. Sandstone aquifers have potential for artificial recharge, induced interaquifer leakage, conjunctive use with surface water, and temporary mining of ground water. Limestone and dolomite aquifer have potential for development of a large water supply, induced increase in recharge, and induced interaquifer leakage. Saline ground water occurs throughout the region, but is most abundant in deep aquifers in Wyoming, North Dakota, and South Dakota. Improved water use in the Missouri Basin Region would require a periodic inventory of current supplies in precipitation, streamflow, surface-water storage, and ground water; an awareness of the many possible alternatives to meet demands; and implementation of sound water-management plans. (Woodard-USGS)
W79-05152

NEBRASKA WATER DATA PROGRAMS, 1978,
Geological Survey, Lincoln, NE. Water Resources Div.
Geological Survey open-file report 78-823, 1978. 131 p, 2 fig, 1 tab, 57 ref, append.

Descriptors: *Nebraska, *Water resources development, *Programs, *Data collections, *Water quality, Surface waters, Groundwater, Aquifers, Water yield, Streamflow, Gaging stations, Sediment transport, Water analysis, Chemical analysis, Projects, Publications, Bibliographies, *State agencies, *U.S. Geological Survey.

Projects of the Water Resources Division, U.S. Geological Survey, and of State agencies represented by members of the Nebraska Water Data Coordinating Committee are described. The committee members represent the Nebraska Department of Water Resources, Nebraska Department of Environmental Control, Nebraska Department of Health, Conservation and Survey Division of the University of Nebraska-Lincoln, Nebraska Water Resources Center of the University of Nebraska, Nebraska Natural Resources Commission, and Nebraska Game and Parks Commission. Current measuring sites are listed. Indexes to streamflow records and flood-prone area maps and a list of recently published reports also are included. Sources of water-related information are given with names, addresses, and telephone numbers. (Woodard-USGS)
W79-05160

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1977,
Geological Survey, Helena, MT. Water Resources Div.
Geological Survey Water-Data Report MT-77-1, October 1978. 751 p, 10 fig, 5 tab.

Descriptors: *Montana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Montana consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 209 gaging stations, stage only records for 1 lake station, stage and contents for 9 lakes and reservoirs, water quality for 112 stations and 3 lakes, and water levels for 23 observation wells. Also included are 191 crest-stage partial-record stations and 52 smaller reservoirs. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Montana. (Woodard-USGS)
W79-05162

FLOOD AND RELATED DEBRIS FLOW HAZARDS MAP,
Geological Survey, Carson City, NY. Water Resources Div.
T. L. Katzer, and P. A. Glancy.
Nevada Bureau of Mines and Geology Environmental Series Map, 1978. 1 sheet.

Descriptors: *Maps, *Floods, *Flood plains, *Debris avalanches, *Sediment transport, *Particle size, Boulders, Fine aggregates, California, Nevada, *South Lake Tahoe quadrangle, *Truckee River basin, *Flood-debris hazard zone.

Estimates of the 100-year floodflow were made and the corresponding flood plains were outlined on the map (scale 1:24,000) for the principal streams in the South Lake Tahoe quadrangle, California-Nevada. Degrees of hazard were assigned to the flood plains of these streams on the basis of floodflows and potential debris movement and are depicted on the map. (Woodard-USGS)
W79-05165

THE UNITED STATES GEOLOGICAL SURVEY IN ALASKA: ACCOMPLISHMENTS DURING 1977.
Geological Survey, Reston, VA. Water Resources Div.
Available Branch of Distribution, USGS 1200 S. Eads St. Arlington, VA 22202. Geological Survey Circular 772-B, 1978. 115 p, 48 fig, 5 tab.

Descriptors: *Alaska, *Projects, *Water resources, *Hydrology, *Geology, Maps, Bibliographies, Environmental engineering, Engineering geology, Marine geology, Mineralogy, Economics, Data collections, Analytical techniques, *U.S. Geological survey, *Annual report of accomplishments(1977).

United States Geological Survey projects in Alaska study a wide range of topics of economic and scientific interest. Work done in 1977 includes contributions to economic geology, regional geology, stratigraphy, engineering geology, hydrology, and marine geology. Many maps and reports covering various aspects of the geology and mineral and water resources of the State were published. In addition, the published 1:1,000,000-scale map of the State has been revised in two areas. A bibliography containing 263 reports on Alaska published in 1977 is included. (Woodard-USGS)
W79-05167

DATA FILE: NEW BEDFORD HARBOR, MASSACHUSETTS,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2L.
W79-05249

USERS MANUAL: DATA STORAGE AND RETRIEVAL SYSTEM FOR PILOT WASTEWATER TREATMENT RESEARCH,
Cincinnati Univ., OH. Southwestern Ohio Regional Computer Center.
G. A. Fish, and S. L. Forsythe.
EPA-600/2-78-036, Environmental Protection Technology Series, Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH., March 1978. 99 p, 11 fig.

Descriptors: *Computer programs, *Waste treatment, *Automatic data processing, Pilot plant, Water reclamation, Mathematical models, Systems analysis, Advanced wastewater treatment, Evaluation, Pollutants, Effects, Waste water(Pollution).

The computer system described herein was designed as a data storage and retrieval system for the water reuse project at the Blue Plains Treatment Plant located in Washington, DC. The system was designed to be run on EPA's UNIVAC 1110 located at Research Triangle Park, North Carolina and thus would require modification to be transferable to other computer systems. The Municipal Environmental Research Laboratory, MERL, was responsible for the water reuse project which was undertaken for the purpose of evaluating Advanced Waste Treatment Systems which have the potential for reliably producing potable quality water from municipal wastewater. The pilot study was intended to evaluate the effectiveness of various processes in removing specific pollutants from wastewater. The six processes being evaluated at Blue Plains were Lime Clarification, Nitrification, Denitrification, Carbon Absorption, Filtration, and Chlorination. This 'User's Manual' describes the programs and files of the system, the use of terminals while utilizing the system, and what the user needs to do to operate the five functions of the system. (Bell-Graf-Cornell)
W79-05281

A CONCEPTUAL MODEL OF THE KNOWLEDGE TRANSFER PROCESS,
Colorado State Univ., Fort Collins. Dept. of Sociology.
For primary bibliographic entry see Field 10D.
W79-05410

8. ENGINEERING WORKS

8A. Structures

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF SOLDIER CREEK DAM PROJECT, UTAH.
Wahler (W. A.) and Associates, Palo Alto, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 681, Price codes: A06 in paper copy, A01 in microfiche. June 1977. 110 p, 8 fig, 6 tab, 44 ref, 1 append, 10 photo. Dept Int 14-01-0001-77-C-10.

Descriptors: *Hydraulic structures, *Dams, *Design, *Evaluation, *Utah, Dam design, Grouting, Earth dams, Dam construction, Outlet works, Reservoir operation, Safety, Dam foundations, Grout curtains, Stability, Seepage, *Soldier Creek Dam(UT), *Central Utah Project, Zoned embankments, Dam safety.

This study was an independent review of critical engineering data and documentation supplied by the Bureau of Reclamation. No independent site or materials investigations or tests were made. The purpose of the review was to determine if there are any apparent risks of serious distress or failure in

filling the reservoir or project operation. Recommendations were made of prudent actions that should be accomplished to provide additional verification of project safety. It was concluded from available data that there may be significant risk of serious distress and/or failure associated with filling the reservoir behind Soldier Creek Dam. The limited data indicated several possible deficiencies which could jeopardize the safety of the dam. Adequate performance instrumentation is lacking, and the foundation surface preparation does not conform to current state-of-the-art practices and may be inadequate. (Humphreys-ISWS)
W79-05239

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF MOUNTAIN PARK DAM PROJECT, OKLAHOMA,
Wahler (W. A.) and Associates, Palo Alto, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 679, Price codes: A07 in paper copy, A01 in microfiche. June 1977. 118 p, 10 fig, 6 tab, 84 ref, 1 append, 16 photo. Dept Inst 14-01-0001-77-C-10.

Descriptors: *Hydraulic structures, *Dams, *Design, *Evaluation, *Oklahoma, Hydraulic design, Dam design, Concrete dams, Outlet works, Arch dams, Dam construction, Dikes, Stability, Spillways, Reservoir operation, Dam foundations, Safety, *Mountain Park Dam project(OK), Dam safety.

This study was an independent review of critical engineering data and documentation supplied by the Bureau of Reclamation. No independent site or materials investigations or tests were made. The purpose of this review was to determine if there are any apparent risks of serious distress or failure in filling the reservoir or project operation. Recommendations were made of prudent actions that should be accomplished to provide additional verification of project safety. It was concluded that the site exploration and testing for design were adequate; the design of the dam is appropriate; and the construction of the dam and dikes was in conformance to construction specifications. (Humphreys-ISWS)
W79-05240

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF MT. ELBERT FOREBAY DAM AND RESERVOIR PROJECT, COLORADO,
Wahler (W. A.) and Associates, Palo Alto, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 680, Price codes: A06 in paper copy, A01 in microfiche. June 1977. 96 p, 10 fig, 1 tab, 46 ref, 1 append, 12 photo. Dept Int 14-01-0001-77-C-10.

Descriptors: *Hydraulic structures, *Dams, *Design, *Evaluation, *Colorado, Dam design, Hydraulic design, Stability, Earth dams, Dam construction, Forebays, Embankments, Outlet works, Dikes, Penstocks, Safety, Intakes, Dam foundations, Reservoir operation, *Mt. Elbert Project(CO), *Fryingpan-Arkansas Project, Dam safety, Dam stability, Zoned embankments, Impervious blankets.

This study was an independent review of critical engineering data and documentation supplied by the Bureau of Reclamation. No independent site or materials investigations or tests were made. The purpose of this review was to determine if there are any apparent risks of serious distress or failure in filling the reservoir or project operation. Recommendations were made as to suggested prudent actions that should be accomplished to provide additional verification of project safety. The study indicated that the filling of the Mt. Elbert Forebay Reservoir should be delayed until certain engineering studies, reservoir blanket repairs, penstock gate control system modifications, and installation of augmented performance surveillance instrumentation have been completed. The reservoir should not be filled above elevation 9,620 ft until the reliability of Power Plant Unit 1, for making emergency reservoir releases, has been demonstrated. (Humphreys-ISWS)
W79-05241

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF CRYSTAL DAM PROJECT, COLORADO,
Wahler (W. A.) and Associates, Palo Alto, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 683, Price codes: A06 in paper copy, A01 in microfiche. May 1977. 104 p, 10 fig, 3 tab, 87 ref, 1 append, 16 photo. Dept Int 14-01-0001-77-C-10.

Descriptors: *Hydraulic structures, *Dams, *Design, *Evaluation, *Colorado, Arch dams, Dam construction, Dam design, Outlet works, Stability, Dam foundations, Seepage, *Crystal dam project(CO), Dam stability.

This study was an independent review of critical engineering data and documentation supplied by the Bureau of Reclamation. No independent site or materials investigations or tests were made. The purpose of this review was to determine if there are any apparent risks of serious distress or failure in filling the reservoir or project operation. Recommendations were made of prudent actions that should be accomplished to provide additional verification of project safety. It was concluded that the site investigations, design, and construction of the dam were conceived and implemented thoroughly and competently. Crystal Dam has inherent safety advantages because of the geologic characteristics of the terrain and the remote location. (Humphreys-ISWS).
W79-05242

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF PUEBLO DAM PROJECT, COLORADO,
Wahler (W.A.) and Associates, Palo Alto, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 678, Price codes: A07 in paper copy, A01 in microfiche. June 1977. 168 p, 14 fig, 9 tab, 159 ref, 1 append, 12 photo. Dept Int 14-01-000C-10

Descriptors: *Hydraulic structures, *Dams, *Design, *Colorado, *Evaluation, *Hydraulic design, Dam design, Reservoir operation, Buttress dams, Concrete dams, Dam foundations, Dam construction, Earth dams, Outlet works, Embankments, Spillways, Stability, Safety. *Pueblo Dam Project(CO), *Dam safety, Fryingpan-Arkansas Project, Zoned embankments, Dam stability.

This study was an independent review of critical engineering data and documentation supplied by the Bureau of Reclamation. No independent site or materials investigations or tests were made. The purpose of this review was to determine if there are any apparent risks of serious distress or failure in filling the reservoir or project operation. Recommendations were made of prudent actions that should be accomplished to provide additional verification of project safety. On the basis of available information, it was concluded that the reservoir behind Pueblo Dam should not be permitted to rise above its present level unitil certain supplementary investigations and/or actions have been completed. A principal concern relates to the staility and performance of the earth-fill embankments. Also, although the design and construction of the central concrete structure (massive-head buttresses) appear to have been executed adequately, its performance may be less favorable than expected. (Humphreys-ISWS).
W79-05243

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF RIRIE DAM PROJECT, IDAHO,
Wahler (W. A.) and Associates, Palo Alto, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 684, Price codes: A08 in paper copy, A01 in microfiche. May 1977. 132 p, 10 fig, 3 tab, 35 ref, 1 append, 14 photo. 14-01-0001-77-C-10.

Descriptors: *Hydraulic structures, *Dams, *Design, *Evaluation, *Idaho, Earth dams, Rockfill dams, Outlet works, Stability, Dam construction, Dam foundations, Embankments, Seepage, *Ririe Dam(ID), Zoned embankments, Dam stability.

This study was an independent review of critical engineering data and documentation supplied by the Bureau of Reclamation and the Corps of Engineers. No independent site or materials investigations or tests were made. The purpose of this review was to determine if there are any apparent risks of serious distress or failure in filling the reservoir or project operation. Recommendations were made of prudent actions that should be accomplished to provide additional verification of project safety. It appears that the site investigation, design, and construction were carried out thoroughly and competently. Some general recommendations were provided. (Humphreys-ISWS)
W79-05244

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF NAMBE FALLS DAM PROJECT, NEW MEXICO.
Wahler (W.A.) and Associates, Palo Alto, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 682, Price codes: A07 in paper copy, A01 in microfiche. May 1977. 131 p, 7 fig, 1 tab, 97 ref, 1 append, 8 photo. Dept Int 14-01-0001-77-C-10.

Descriptors: *Hydraulic structures, *Dams, *Design, *Evaluation, *New Mexico, Arch dams, Earth dams, Safety, Dam, foundations, Loads(Forces), Grouting, Grout curtains, Seepage, Dam construction. *Nambe Falls Dam(NM), *San Juan-Chama Project, Zoned embankments, Dam safety, Thrust blocks.

This study was an independent review of critical engineering data and documentation supplied by the Bureau of Reclamation. No independent site or materials investigations or tests were made. The purpose of this review was to determine if there are any apparent risks of serious distress or failure in filling the reservoir or project operation. Recommendations were made of prudent actions that should be accomplished to provide additional verification of project safety. It was recommended that Nambe Falls reservoir not be allowed to fill until the Bureau carefully assesses the risks associated with certain areas of concern. (Humphreys-ISWS).
W79-05247

CONCEPTUAL REVIEW AND PRELIMINARY DESIGN OF MULTIFARIOUS WATER INTAKE STRUCTURES,
Polytechnic Inst. of New York, Brooklyn. Dept. of Civil and Environmental Engineering.
A. S. Goodman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 965, Price codes: A08 in paper copy, A01 in microfiche. Report No. NYSERDA 75/29, August 1977. 159 p, 21 fig, 7 tab, 30 ref, 7 append.

Descriptors: *Intake structures, *Fish guiding, *Fish barriers, *Hydraulic structures, *Tidal streams, Estuaries, Tidal effects, Cooling water, Electric power plants, Fish behavior, Velocity, Design, *Traveling screens.

Planning analyses and preliminary design drawings were presented for a multifarious water intake structure which implies many parts or elements. Layout and operating details are for an intake serving a 350-550 Mw thermal power generating unit located on an estuary. The approximate cost would be $12 million. The principal design features are: adjustable louvers to act as a behavioral barrier to fish; curtain walls in front of the screens to provide for selective water admission to reduce impingement of aquatic organisms; horizontal traveling screens which move in the direction and speed of ambient water flow to guide fish and reduce the degree of impingement; and fish handling facilities to convey organisms back to their

natural environment. The intake, as a whole, is a major departure from the current state-of-the-art of intake design. (Adams-ISWS)
W79-05248

8B. Hydraulics

BEHAVIOUR OF A HYDRODYNAMIC FINITE ELEMENT MODEL,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
R. A. Harrington, N. Kouwen, and G. J. Farquhar.
Advances in Water Resources, Vol. 1, No. 6, p 331-335, December 1978. 9 fig, 6 ref.

Descriptors: *Hydrodynamics, *Flow, *Model studies, Mathematical models, Finite element analysis, Equations, Analytical techniques, Streamflow, Discharge(Water), Rivers, Jetties, Outlet works, Hydraulics.

A finite element model which solves the vertically integrated momentum and continuity equations was described. Linear triangular elements were used to describe the geometry and parameter variations. The Galerkin method of weighted residuals was employed to cast the equations in a form amenable to numerical solution. The model was based on a fully implicit formulation using finite differences for the temporal derivatives. Means of evaluating the non-linear terms of the governing equations were described, and model results were presented for a frictionless tidal channel. The example was chosen such that the non-linearities have a large influence on the solution, and as a result the linearization scheme significantly affects the model's behavior. Suppression of the non-linear instabilities generated by the convective terms in the momentum equations was examined for the case of flow around a 180 deg bend. Both the imposition of artificially high roughness coefficients and the use of an effective eddy viscosity were examined in terms of their ability to damp the oscillations which arise for this example. Model results were presented for a case study involving determination of remedial measures to improve flow conditions at a river outfall in Southern Ontario. (Sims-ISWS)
W79-05020

PRESSURE LOSSES ACROSS TRICKLE IRRIGATION FITTINGS AND EMITTERS,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
T. A. Howell, and F. A. Barinas.
Paper No. 78-2014, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 12 p, 16 fig, 1 tab, 7 ref, ASAE, St. Joseph, Michigan.

Descriptors: Energy loss, *Irrigation design, Flow rates, Pipelines, Pressure conduits, Irrigation systems, Water pressure, Hazen-Williams equation.

Pressure losses across on-line trickle emitters were measured. The energy losses as expressed by the equivalent length of pipe were described by a power function. The empirical coefficients were related to the emitter characteristics of protrusion depth and area. Lateral design procedures and examples are presented. Pressure losses across PVC and PE barbed fittings were measured. (Skogerboe-Colorado State)
W79-05060

TRICKLE IRRIGATION TUBING HYDRAULICS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
G. Z. Watters, and J. Keller.
Paper No. 78-2015, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 18 p, 16 fig, 2 tab, 12 ref, ASAE, St. Joseph, Michigan.

Descriptors: Pipe flow, *Irrigation systems, Head loss, Darcy-Weisbach equation, Moody resistance diagrams, *Pipelines, Hazen-Williams equation, Trickle irrigation.

Laboratory experiments show that the Darcy-Weisbach equation for hydraulically smooth pipes should be used to compute friction losses in PVC pipe and plastic tubing. Simple formulas are presented to accomplish this. Graphs to find equivalent lengths for emitter connection losses are given. Techniques for calculating head losses in multiple-outlet lines are presented. (Skogerboe-Colorado State)
W79-05061

SIMULATED FLOW RATE REQUIREMENTS FOR SOME FLUSHING EMITTERS,
Rain Bird Technical Services, Logan, UT.
K. Solomon, and J. C. Bezdek.
Paper No. 78-2016, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 18 p, 3 fig, 5 tab, 8 ref, ASAE, St. Joseph, Michigan.

Descriptors: *Flow rates, Simulation analysis, Hydraulic models, *Trickle irrigation, Lateral conveyance structures, Model studies, Irrigation systems, Water pressure.

A steady state simulation model was used to study the hydraulic behavior of trickle irrigation laterals and manifolds employing automatic flushing emitters. The influence of emitter characteristics and design values such as emitter operating pressure, flow rate, spacing, and lateral length were considered. (Skogerboe-Colorado State)
W79-05062

FLOW RESISTANCE OF LARGE-SCALE ROUGHNESS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-05141

THE GROWTH AND DECAY OF A HYDRAULIC JUMP,
University Coll., Galway (Ireland).
M. F. McCarthy, and P. M. O'Leary.
Journal of Hydrology, Vol. 39, No. 3/4, p. 273-285, December 1978. 4 fig, 9 ref.

Descriptors: *Hydraulic jump, *Canals, *Waves(Water), Bores, Analysis, Mathematical studies, Equations, Hydraulics, Numerical analysis, Wave propagation, Critical jump, Amplitude, Shallow water waves, Shock amplitude equation.

Discontinuity analysis is employed to study the progagation of a hydraulic jump in a canal of uniform width but variable length. In particular, a differential equation was derived which determines the manner in which the height of the jump varies as the wave propagates, and the criteria were established which must be satisfied if the wave is to grow, decay, or propagate at constant amplitude. (Lee-ISWS)
W79-05146

MODELING TWO-DIMENSIONAL CIRCULATING FLOW,
Hydraulics Research Station, Wallingford (England).
G. H. Lean, and T. J. Weare.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, Proceedings Paper 14312, p 17-26, January 1979. 3 fig, 10 ref, 2 append.

Descriptors: *Circulation, *Model studies, *Flow, Dispersion, Hydraulics, Mathematical models, Numerical analysis, Hydraulic models, Shear stress, Equations, Turbulence, Laboratory tests. *Fluid flow.

Theoretical analysis and numerical experiments were presented to demonstrate some of the difficulties in modeling two-dimensional circulating flow. It was shown that in cases of practical interest, the lateral mixing of momentum, which is essential to support the circulation, can arise in computational models from wholly spurious numerical dispersion effects. Laboratory flume measurements of the flow in the wake of a plane obstruction were presented. It was shown that the horizontal velocity profiles across the eddy indicate that the turbulent lateral mixing rate is appropriate to a shear layer mixing rather than to bed-generated turbulence. Criteria for the conditions under which shear layer turbulence dominates were presented. The practical implications for numerical and physical models were reviewed. (Lee-ISWS).
W79-05255

A MODEL STUDY OF ST. MARYS RIVER ICE NAVIGATION,
Acres International Ltd., Niagara Falls (Ontario).
For primary bibliographic entry see Field 2C.
W79-05278

8C. Hydraulic Machinery

A SOLAR-POWERED PUMP FOR IRRIGATION,
Battelle Columbus Labs., OH.
For primary bibliographic entry see Field 3F.
W79-05287

8D. Soil Mechanics

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF SOLDIER CREEK DAM PROJECT, UTAH.
Wahler (W. A.) and Associates, Palo Alto, CA.
For primary bibliographic entry see Field 8A.
W79-05239

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF MOUNTAIN PARK DAM PROJECT, OKLAHOMA,
Wahler (W. A.) and Associates, Palo Alto, CA.
For primary bibliographic entry see Field 8A.
W79-05240

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF MT. ELBERT FOREBAY DAM AND RESERVOIR PROJECT, COLORADO,
Wahler (W. A.) and Associates, Palo Alto, CA.
For primary bibliographic entry see Field 8A.
W79-05241

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF CRYSTAL DAM PROJECT, COLORADO,
Wahler (W. A.) and Associates, Palo Alto, CA.
For primary bibliographic entry see Field 8A.
W79-05242

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF PUEBLO DAM PROJECT, COLORADO,
Wahler (W.A.) and Associates, Palo Alto, CA.
For primary bibliographic entry see Field 8A.
W79-05243

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF RIRIE DAM PROJECT, IDAHO,
Wahler (W. A.) and Associates, Palo Alto, CA.
For primary bibliographic entry see Field 8A.
W79-05244

REVIEW OF DESIGN, CONSTRUCTION, AND OPERATION OF NAMBE FALLS DAM PROJECT, NEW MEXICO.
Wahler (W.A.) and Associates, Palo Alto, CA.
For primary bibliographic entry see Field 8A.
W79-05247

8I. Fisheries Engineering

CONCEPTUAL REVIEW AND PRELIMINARY DESIGN OF MULTIFARIOUS WATER INTAKE STRUCTURES,
Polytechnic Inst. of New York, Brooklyn. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 8A.
W79-05248

9. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

ANALYSIS OF RESEARCHABLE WATER PROBLEMS IN THE SOUTH ATLANTIC-GULF REGION,
Florida Univ., Gainesville. Water Resources Research Center.
Water-Resources Research Center, University of Florida Technical Completion Report, 1979. 59 p. OWRT X-133 (No. 9076)(1), 14-31-0001-9076.

Descriptors: *Research priorities, Southeastern US.

The South Atlantic-Gulf Region is generally abundantly supplied with water – both surface and underground. However, man's activities have created problems of both water quantity and water quality. The effects of improper water planning and management have been devastating in some instances. Systematic analysis of the water resources problems of the region by the directors of the water resources research institutes of the respective states produced the lists of major regional problems and critical research needs presented. (Heaney-Florida)
W79-05401

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

THE WORLD REMOTE SENSING INDEX, A COMPREHENSIVE GEOGRAPHIC INDEX BIBLIOGRAPHY TO REMOTE SENSING SITE INVESTIGATIONS OF NATURAL AND AGRICULTURAL RESOURCES THROUGHOUT THE WORLD,
For primary bibliographic entry see Field 7B.
W79-05119

10D. Specialized Information Center Services

WATER KNOWLEDGE TRANSFER: PROCEEDINGS, SECOND INTERNATIONAL CONFERENCE ON TRANSFER OF WATER RESOURCES KNOWLEDGE, JUNE 1977, FORT COLLINS, COLO.,
Water Resources Publications, Fort Collins, Colo., 1978. 2 Vols. Neil S. Grigg, Principal Editor.

Descriptors: *Information dissemination, *Technology transfer.

Water resources knowledge transfer seeks to make best use of scientific and technical information in water management. It is an important process in water research management because its outcome determines the effectiveness of entire programs. The report contans an analysis of the problem in the water sector, a general overview of the 'technology transfer' question, presentation of conceptual models for transfer, and recommendations for policy changes. (See W79-05410 thru W79-05413)
W79-05409

A CONCEPTUAL MODEL OF THE KNOWLEDGE TRANSFER PROCESS,
Colorado State Univ., Fort Collins. Dept. of Sociology.
E. Vlachos.
In: Water Knowledge Transfer. Volume 1, Proceedings of the Second International Conference on Transfer of Water Resources Knowledge, June 1977, Fort Collins, Colorado. N.S. Grigg, et al., Eds., Water Resources Publications, Fort Collins, Col., 1978, p 5-22. 2 fig, 17 ref.

Descriptors: *Water resources, *Information transfer, *Communication, Technology, SMCR model, Diffusion of knowledge, Feedback, Transmission process.

This present Conference, as well as the first international conference on water knowledge transfer, had to grapple with problems of semantics, theoretical differentiations, and difficulties in separating 'information dissemination' from 'technology transfer,' 'science,' 'production,' and a great variety of other terms, definitions, concepts, or theoretical constructs. The field of water resources knowledge has experienced the same growth and transfer problems and opportunities. A variety of producers of knowledge, of overlapping transfer agents, and of ultimate users participate in a complex system of information exchange. This Conference, as well as its predecessor conference, has attempted to develop a systematic framework exemplified by a series of interlocking questions, in order to better understand such a complex system and to take stock of trends and developments in the field of water resources. This paper attempts to provide a continuity in themes between the two international conferences and also outlines some broad concerns associated with the general topic of transfer of knowlege. Discussed are (1) the general field of knowledge transfer; (2) some dominant theoretical approaches and interpretations; (3) the characteristics of the transfer process; and (4) problems and prospects associated with the diffusion and implementation of knowledge. An important conclusion drawn is that the capability of individuals to assimilate knowledge is highly dependent on the capacity of the surrounding social system to provide mechanisms for change. (See also W79-05409) (Bell-Graf--Cornell)
W79-05410

STORMWATER MANAGEMENT MODEL: TRANSFER OF TECHNOLOGY,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
For primary bibliographic entry see Field 5B.
W79-05412

A WATER DEMAND AND WASTEWATER DISPOSAL MODEL FOR OPTIMUM TRANSFER OF WATER RESOURCES TECHNOLOGY IN DEVELOPING COUNTRIES,
Federal Univ. of Paraiba, Campina Grande (Brazil). Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W79-05413

SUBJECT INDEX

ABSORPTION
Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

ACARTIA CLAUSII
Population Dynamics and Production of a Planktonic Marine Copepod, Acartia Clausii, in a Small Temperate Lagoon on San Juan Island, Washington,
W79-05346 5C

ACCELERATED EROSION
Reconnaissance Assessment of Erosion and Sedimentation in the Canada De Los Alamos Basin, Los Angeles and Ventura Counties, California,
W79-05172 2J

ACETYLENE REDUCTION
Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

ACID MINE WATER
Acid Mine Water Reverse Osmosis Test at Kittanning, Pennsylvania,
W79-05071 3A

ACOUSTICS
Acoustic Monitoring of Industrial Chemical Waste Release at Deep Water Dump Site 106,
W79-05264 5B

ACROSYMPHYTON PURPURIFERUM
The Short Day Response in Acrosymphyton Purpuriferum (J. Ag.) Sjost. (Rhodophyceae, Crytonemiales),
W79-05325 5C

ACTIVATED SLUDGE
Use of the Activated Sludge Process in the Treatment of Thermomechanical Pulping Effluents,
W79-05425 5D

Control of Activated Sludge Bulking During Biological Purification (Regulirovanie prirosta aktivnogo ila pri biologicheskoi ochistke),
W79-05431 5D

AERATED LAGOONS
Problems Associated with an Aerated Lagoon,
W79-05417 5D

AERIAL PHOTOGRAPHY
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

AEROBIC DIGESTION
New Design Criteria for the Aerobic Digestion of Sewage Lime Sludge,
W79-05009 5D

AGRICULTURAL RUNOFF
Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

AGRICULTURAL WATERSHEDS
Modeling Nitrogen Movement in Agricultural Watersheds,
W79-05069 2G

AGRICULTURE
Water Production Functions for Irrigated Agriculture,
W79-05275 3F

AIR POLLUTION EFFECTS
Effect of Sulfur Dioxide on Algae,
W79-05352 5C

AIRCRAFT
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

AIRTHREY LOCH (SCOTLAND)
Community Production and Respiration by Ciliated Protozoa in the Benthos of a Small Eutrophic Loch,
W79-05354 5C

ALABAMA
7-Day Low Flows and Flow Duration of Alabama Streams Through 1973,
W79-05166 2E

ALASKA
Summary Appraisals of the Nation's Ground-Water Resources--Alaska,
W79-05153 2F

The United States Geological Survey in Alaska: Accomplishments During 1977.
W79-05167 7C

ALFALFA
Effect of Transpiration Rate on the Uptake of Mineral Elements by Alfalfa Plants (In Bulgarian),
W79-05321 2I

ALGAE
Algae and Water Pollution,
W79-05322 5C

Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

Algae of Saltmarshes on the South and Southwest Coasts of England,
W79-05335 5C

Productivity Studies on Baltic Macroalgae,
W79-05347 5C

ALGAL CONTROL
Algae and Water Pollution,
W79-05322 5C

ALKALINITY
Dynamic Changes in pH and Composition of Absorbed Cations in Irrigated Chernozems of the Trans-Volga Area (In Russian),
W79-05226 2K

ALLUVIAL CHANNELS
Relationship Between Alluvial Soils and Flooding in the Piedmont Lowland of Southeastern Pennsylvania,
W79-05017 2E

Fluvial Processes and Facies Sequences in the Sandy Braided South Saskatchewan River, Canada,
W79-05135 2J

ALTERNATIVE PLANNING
Continuous Simulation for Water Quality Planning,
W79-05010 6B

ALUMINUM
Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

ALUMINUM ALLOYS
Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

AMINO ACIDS
The Chemical Composition of Aquatic Macrophytes. II. Amino Acid Composition of the Protein and Non-Protein in Fractions,
W79-05330 5C

AMOCO CADIZ
Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

Editorial Introduction,
W79-05188 5A

The Amoco Cadiz Oil Spill-Lines of Study and Early Observations,
W79-05189 5A

The Ecological Impact on and Near Shores by the Amoco Cadiz Oil Spill,
W79-05190 5B

Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

Notes on the Condition in September 1978 of Some Intertidal Sands Polluted by Amoco Cadiz Oil,
W79-05193 5B

Preliminary Observations on Pollution of the Sea Bed and Disturbance of Sub-Littoral Communities in Northern Brittany by Oil from the Amoco Cadiz,
W79-05194 5B

The Amoco Cadiz Oil Spill. A Summary of Observations Made By U.S. Scientists 23 March-10 May, 1978,
W79-05195 5C

Petroleum Hydrocarbon Analyses Conducted Following the Wreck of the Supertanker Amoco Cadiz,
W79-05196 5A

ANABAENA FLOS-AQUAE
Effect of Sulfur Dioxide on Algae,
W79-05352 5C

ANACYSTIS NIDULANS
Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

ANALYTICAL TECHNIQUES
An Example of the Use of Factor Analysis and Cluster Analysis in Groundwater Chemistry Interpretation,
W79-05143 2F

On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

ANALYTICAL TECHNIQUES

Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

Optimizing Trihalomethane Analysis,
W79-05476 5A

Evaluation of the Capability of Granular Activated Carbon and Resins to Remove Chlorinated and Other Trace Organics from Treated Drinking Water,
W79-05478 5C

Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

ANIMAL PATHOLOGY
Pollution-Associated Diseases and Abnormalities of Fish and Shellfish: A Review,
W79-05097 5C

ANIMAL POPULATIONS
Preliminary Observations on Pollution of the Sea Bed and Disturbance of Sub-Littoral Communities in Northern Brittany by Oil from the Amoco Cadiz,
W79-05194 5B

ANION
Test Manual (Tentative) for Permselective Membranes.
W79-05086 3A

ANNUAL REPORT OF ACCOMPLISHMENTS (1977)
The United States Geological Survey in Alaska: Accomplishments During 1977.
W79-05167 7C

ANTARCTIC
The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

ANTARCTIC OCEAN
The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

ANTARCTIC POLAR FRONTS
The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

ANTECEDENT MOISTURE CONTENT
Runoff Curve Numbers with Varying Site Moisture,
W79-05023 2D

APPALACHIAN MOUNTAIN REGION
Copper, Nickel, and Zinc Released from Acid Coal Mine Spoil Materials of Eastern Kentucky,
W79-05044 5A

APPLICATION EQUIPMENT
Spray Nozzle,
W79-05374 3F

AQUATIC ALGAE
The Riou-Mort a Tributary to the River Lot Polluted by Heavy Metals. I. Preliminary Observations on the Chemistry and Benthic Algae,
W79-05206 5B

AQUATIC INSECTS
Interacting Effects of Minimum Flow and Fluctuating Shorelines on Benthic Stream Insects,
W79-05233 2E

Kansas River Limnology: Seasonal Variations in Photosynthetic Production and Heavy Metal Accumulation by Aquatic Insects,
W79-05234 5C

AQUATIC LIFE
Toxicity of Treated and Untreated P. (Pinus) Radiata TMP (Thermomechanical Pulping) Effluents on a Number of Organisms,
W79-05426 5C

AQUATIC WEED CONTROL
Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

AQUICULTURE
Self-Contained Upwelling System for Rearing Larval Fishes in the Laboratory,
W79-05182 5A

Atlantic Salmon Embryos and Fry: Effects of Various Incubation and Rearing Methods on Hatchery Survival and Growth,
W79-05187 5C

Evaluation of pH Shock on Hatchery-Reared Rainbow Trout,
W79-05202 5C

Announcement of Compounds Registered for Fishery Uses,
W79-05205 5A

Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

AQUIFER CHARACTERISTICS
Summary Appraisals of the Nation's Ground-Water Resources--Missouri Basin Region,
W79-05152 7C

Biscayne Aquifer, Southeast Florida,
W79-05155 3H

AQUIFERS
The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume I.
W79-05014 2F

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

Distributed Sources for Unconfined Groundwater Flow in a Half-Space,
W79-05025 2F

A Non-Linear Optimization Method for the Estimation of Aquifer Parameters,
W79-05026 2F

ARIZONA
Annual Summary of Ground-Water Conditions in Arizona, Spring 1977 to Spring 1978,
W79-05151 4B

AROMATIC HYDROCARBONS
Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

ARTIFICIAL RECHARGE
Artificial Recharge on Long Island, New York,
W79-05169 4B

ASEXUAL REPRODUCTION
Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

ASH
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

ATLANTIC OCEAN
Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

ATLANTIC SALMON
Atlantic Salmon Embryos and Fry: Effects of Various Incubation and Rearing Methods on Hatchery Survival and Growth,
W79-05187 5C

ATP
Effect of DBS Detergent on Activity of Some Enzymes of Young Carp (Cyprinus carpio L.) Brain, Gills and Serum,
W79-05177 5C

AUSTRALIA
The Development of Overland Flow in a Tropical Rainforest Catchment,
W79-05030 2A

AUTOMATIC CONTROL
Solid State Control Systems for Irrigation,
W79-05289 3F

AUTOMATIC DATA PROCESSING
Users Manual: Data Storage and Retrieval System for Pilot Wastewater Treatment Research,
W79-05281 7C

AUTOMATION
Automation of Surface Irrigation,
W79-05305 3F

AVERAGE FLOW
7-Day Low Flows and Flow Duration of Alabama Streams Through 1973,
W79-05166 2E

BACKWATER
Mathematical Modeling of Sediment Deposition in Reservoirs,
W79-05142 2J

BACTERIA
Bacterial Clogging in Low Pressure Irrigation Systems,
W79-05312 3F

The Growth Patterns of Some Enteric Bacteria in a Kraft Pulp Mill/Domestic Sewage Combined Treatment System,
W79-05420 5D

Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

BAJA CALIFORNIA (MEXICO)
The Phytoplankton Characteristics of the Barrier Island Lagoons of the Gulf of California,
W79-05337 5C

BAKERSFIELD (CA)
Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

BALTIC SEA
Productivity Studies on Baltic Macroalgae,
W79-05347 5C

BANKFULL
Scour and Fill in a Stream Channel, East Fork River, Western Wyoming,
W79-05149 2J

BARGES
A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

BARIUM
Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

BARLEY
Effect of Soil Humidity on Nitrate Reductase Activity in Barley Shoot Leaves (In Russian),
W79-05314 2I

BASELINE STUDIES
Water-Quality Investigation of the Vache Grasse Creek Watershed, Sebastian County, Arkansas,
W79-05158 6A

Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development,
W79-05212 5C

The Effects of Oil on Temperature Regulation in Sea Otters,
W79-05214 5C

BASS
Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

BAYS
Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

BEAR CREEK BASIN
Storm-Water Data for Bear Creek Basin, Jackson County, Oregon, 1977-78,
W79-05171 5B

BED FORMS
Effective Depth in Channels Having Bed Undulations,
W79-05254 2J

BEDS
Effective Depth in Channels Having Bed Undulations,
W79-05254 2J

BENTHIC FAUNA
Editorial Introduction,
W79-05188 5A

Community Production and Respiration by Ciliated Protozoa in the Benthos of a Small Eutrophic Loch,
W79-05354 5C

BENTHIC FLORA
The Use of Species Abundance Estimates in Marine Benthic Studies,
W79-05109 5A

BENTHIC HABITAT
Interacting Effects of Minimum Flow and Fluctuating Shorelines on Benthic Stream Insects,
W79-05233 2E

BERMUDA
Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

BERULA ERECTA
The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

BIBLIOGRAPHIES
The World Remote Sensing Index, A Comprehensive Geographic Index Bibliography to Remote Sensing Site Investigations of Natural and Agricultural Resources Throughout the World,
W79-05119 7B

BIOACCUMULATION
Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

BIOASSAY
Toxicity of Phossy Water to Selected Freshwater Organisms,
W79-05095 5B

A Bioassay Laboratory Boat with Comparisons of Central Vs. Boat Laboratory Bioassay Evaluations,
W79-05111 5A

Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

Evaluation of pH Shock on Hatchery-Reared Rainbow Trout,
W79-05202 5C

Development of a Rapid Tissue Bioassay Technique for Screening Pollutant Effects on Fish,
W79-05229 5A

Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

BIOASSAYS
Modifications of Temperature Avoidance Troughs for Testing Small Fishes,
W79-05185 5A

Survival of Salmon Smolts in Sea Water After Exposure to Air-Supersaturated Water,
W79-05191 5B

BIOCHEMICAL OXYGEN DEMAND
Multiple Bottle Holder for In Situ Measurement of Primary Productivity,
W79-05201 5A

A Rapid Estimation of 5-Day BOD of Spent Sulfite Liquor,
W79-05500 5A

BIOCHEMISTRY
The Chemical Composition of Aquatic Macrophytes. II. Amino Acid Composition of the Protein and Non-Protein in Fractions,
W79-05330 5C

Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

BIODEGRADATION
Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development,
W79-05212 5C

BIOLOGICAL COMMUNITIES
Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forests Streams of Northern California,
W79-05005 5C

Community Production and Respiration by Ciliated Protozoa in the Benthos of a Small Eutrophic Loch,
W79-05354 5C

BIRDS
Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05221 5C

BISCAYNE AQUIFER
Biscayne Aquifer, Southeast Florida,
W79-05155 5B

BLEACH PLANTS
Bleach Plant Operation,
W79-05497 3E

BLEACHING WASTES
The Impact of Oxygen Delignification System on Screen Room and Bleach Plant Effluents,
W79-05423 3E

Development of a Practical Method to Reduce the Toxicity of Kraft Mill Effluents by Retaining some of the Toxic Materials with the Pulp,
W79-05424 5D

BLOCK ISLAND SOUND (NEW YORK)
An Annual Phytoplankton Study in Coastal Waters Off Eastern Long Island (Block Island Sound),
W79-05231 5C

BLUE MARLIN
Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

BOILER FEED WATER
Controlling Iron Oxide Deposition in Boiler Systems,
W79-05498 3C

Boiler Water Treatment: Is the Paper Industry A Special Case,
W79-05499 5F

BOTTOM FEEDERS
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

BOUNDARIES (SURFACE)
Solidification and Separation of Ice from Saline Water,
W79-05357 3A

BOUNDARY LAYERS
A Time-Dependent Model of a Coastal Boundary Layer with Friction,
W79-05263 2H

BRACHIONUS PLICATILIS
Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

BRACKISH WATER CONVERSION DEMONSTRATION PLANT NO. 3
Third Annual Report: Brackish Water Conversion Demonstration Plant, Webster, South Dakota.
W79-05078 3A

BRAIDING
Fluvial Processes and Facies Sequences in the Sandy Braided South Saskatchewan River, Canada,
W79-05135 2J

BRISTOL CHANNEL (ENGLAND)
Algae of Saltmarshes on the South and Southwest Coasts of England,
W79-05335 5C

BROWARD COUNTY
Biscayne Aquifer, Southeast Florida,
W79-05155 5B

BUBBLER SYSTEMS
Computer Simulation of Bubbler-Induced Melting of Ice Covers Using Experimental Heat Transfer Results,
W79-05279 2C

BUFFERS
A Mercury Buffer for Toxicity Experiments with Green Algae,
W79-05210 5A

BULK DENSITY
Errors in Gamma-Ray Measurements of Water Content and Bulk Density in Nonuniform Soils,
W79-05251 2G

CADMIUM
The Riou-Mort a Tributary to the River Lot Polluted by Heavy Metals. I. Preliminary Observations on the Chemistry and Benthic Algae,
W79-05206 5B

Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

CALANUS HELGOLANDICUS
On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

CALCIUM
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

CALCIUM SULFATE
Thermodynamic Properties of Saline Water,
W79-05359 3A

CALIFORNIA
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

Interdisciplinary Team Approach to Mitigating Adverse Environmental Impacts of Highway Construction,
W79-05236 6G

CANADA
Estimating Design Flows for Urban Drainage,
W79-05024 2E

Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

Fluvial Processes and Facies Sequences in the Sandy Braided South Saskatchewan River, Canada,
W79-05135 2J

Melting of a Prairie Snowpack,
W79-05252 2C

Development of a Hydrologic Model for a Canadian Watershed,
W79-05280 2A

CANALS
The Growth and Decay of a Hydraulic Jump,
W79-05146 8B

CAPITAL COSTS
Cost Analysis of Six Water Desalting Processes,
W79-05074 3A

CARBON DIOXIDE
Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

CARNIVOROUS PLANTS
Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

CARP
Histopathological Changes in the Fish After Intoxication with Non-Ionogenic Tensides on the Basis of Ethoxyl Aducts of Isononylphenols (Histopatologicke Zmeny u Ryb Po Intoxikaci Neionogennimi Tenzidy na Bazi Ethoxylovych Aduktu Isononylfenolu),
W79-05099 5C

Effect of DBS Detergent on Activity of Some Enzymes of Young Carp (Cyprinus carpio L.) Brain, Gills and Serum,
W79-05177 5C

The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

CATION
Test Manual (Tentative) for Permselective Membranes.
W79-05086 3A

CENTRAL US
Record Winter Storms in Illinois, 1977-1978,
W79-05013 2B

CENTRAL UTAH PROJECT
Review of Design, Construction, and Operation of Soldier Creek Dam Project, Utah.
W79-05239 8A

CHANNEL CATFISH
Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

CHANNEL EROSION
Sea Research Program for Channel Stability and Gully Control,
W79-05068 2J

CHANNEL MORPHOLOGY
Fluvial Processes and Facies Sequences in the Sandy Braided South Saskatchewan River, Canada,
W79-05135 2J

CHANNELS
Flow Resistance of Large-Scale Roughness,
W79-05141 2E

Effective Depth in Channels Having Bed Undulations,
W79-05254 2J

CHARLES RIVER (MA)
Systematic Diurnal Curve Analysis,
W79-05042 5B

CHATTAHOOCHEE RIVER
Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

CHEMICAL ANALYSIS
The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

Analysis of Chlorinated Hydrocarbon Pollutants: A Simplified Extraction and Cleanup Procedure for Fishery Products,
W79-05110 5A

Methods for Determining the Oxygen Consumption of a Fish Under Conditions of Aquatic Semi-Confinement (Methodes de Determination de la Consommation D'Oxygene D'un Poisson Dans Les Conditions Du Semi-Confinement Aquatique),
W79-05112 5A

Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

Analysis of Urban Storm-Water-Quality from Seven Basins Near Portland, Oregon,
W79-05156 5B

Comparative Studies on Methods for Determining Total Mercury in Fish. Dithizone and Flameless Atomic Absorption Spectrophotometry Techniques,
W79-05183 5B

Petroleum Hydrocarbon Analyses Conducted Following the Wreck of the Supertanker Amoco Cadiz,
W79-05196 5A

CHEMICAL WASTES
Acoustic Monitoring of Industrial Chemical Waste Release at Deep Water Dump Site 106,
W79-05264 5B

CHEMISTRY OF PRECIPITATION
Calcite as a Source of Excess Calcium in Rainwater,
W79-05262 2K

CHERMOZEMS
Dynamic Changes in pH and Composition of Absorbed Cations in Irrigated Chernozems of the Trans-Volga Area (In Russian),
W79-05226 2K

CHESAPEAKE BAY
Vibrio Cholerae, Vibrio Parahaemolyticus, and other Vibrios: Occurrence and Distribution in Chesapeake Bay,
W79-05104 5C

CHINA
Calcite as a Source of Excess Calcium in Rainwater,
W79-05262 2K

CHLAMYDOMONAS REINHARDTII
Effect of Sulfur Dioxide on Algae,
W79-05352 5C

CHLORAMINES
Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

CHLORIDES

Determination of Chloride in Sulfite Pulp Mill Effluents (Chloridbestimmung in Sulfitzellstoff-Ablaugen),
W79-05432 5A

CHLORINATED HYDROCARBON PESTICIDES

Analysis of Chlorinated Hydrocarbon Pollutants: A Simplified Extraction and Cleanup Procedure for Fishery Products,
W79-05110 5A

Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

CHLORINATION

Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

Water Chlorination: Environmental Impact and Health Effects.
W79-05435 5C

Soluble Organic Constituents of Natural Waters and Wastewaters Before and After Chlorination,
W79-05436 5A

Natural and Model Aquatic Humics: Reactions with Chlorine,
W79-05437 5C

Precursors and Mechanisms of Haloform Formation in the Chlorination of Water Supplies,
W79-05438 5A

Reactions of Chlorine, Chlorine Dioxide and Mixtures Thereof with Humic Acid: An Interim Report,
W79-05439 5A

Aqueous Chlorination Products of Polynuclear Aromatic Hydrocarbons,
W79-05440 5A

Aqueous Chlorination of Some Phenolic Acids,
W79-05441 5C

A Program to Introduce Site-Specific Chlorination Regimes at Ontario Hydro Generating Stations,
W79-05442 5C

A Preliminary Look at the Effects of Intermittent Chlorination on Selected Warmwater Fishes,
W79-05443 5C

Toward an Understanding of the Toxicity of Intermittent Exposures of Total Residual Chlorine to Freshwater Fishes,
W79-05444 5C

Influence of Chlorine Form and Ambient Temperature on the Toxicity of Intermittent Chlorination to Freshwater Fish,
W79-05445 5C

The Use of Various Avoidance Indices to Evaluate the Behavioral Response of the Golden Shiner to Components of Total Residual Chlorine,
W79-05446 5C

Avoidance of Monochloramine: Test Tank Results for Rainbow Trout, Coho Salmon, Alewife, Yellow Perch and Spottail Shiner,
W79-05447 5C

Investigation of the Effects of Halogenated Organic Compounds Produced in Cooling Systems and Process Effluents on Aquatic Organisms,
W79-05448 5C

Brominated Compounds Found in Waste-Treatment Effluents and Their Capacity to Bioaccumulate,
W79-05449 5C

Reactions in Chlorinated Seawater,
W79-05450 5A

Chlorine Degradation and Halocarbon Production in Estuarine Waters,
W79-05451 5A

Investigation of Halogenated Components Formed From Chlorination of Marine Water,
W79-05452 5A

The Effect of Ammonia Concentration on the Chemistry of Chlorinated Sea Water,
W79-05453 5A

Microbial Degradation of Halogenated Hydrocarbons,
W79-05454 5A

DDT, PCB and Chlorinated Benzenes in the Marine Ecosystem Off Southern California,
W79-05455 5C

Biological and Chemical Effects of Chlorination at Coastal Power Plants,
W79-05456 5C

Toxicity Screening of Fifteen Chlorinated and Brominated Compounds Using Four Species of Marine Phytoplankton,
W79-05457 5C

Seasonal Chronic Toxicity of Chlorination to the American Oyster, Crassotrea Virginica (G),
W79-05458 5C

Effects of Chlorinated Sea Water on Decapod Crustaceans,
W79-05459 5C

The Relative Sensitivity of Pacific Northwest Fishes and Invertebrates to Chlorinated Sea Water,
W79-05460 5C

Respiratory and Osmoregulatory Responses of White Perch (Morone Americana) Exposed to Chlorine and Ozone in Estuarine Waters,
W79-05461 5C

Continuous Low-Level Chlorination for Marine Fouling Control at Power Stations in the United Kingdom,
W79-05462 5C

Response of Entrained Plankton to Low-Level Chlorination at a Coastal Power Station,
W79-05463 5C

The Epidemiologic Approach to the Evaluation of Organics in Drinking Water,
W79-05464 5C

A Case Control Study of Gastrointestinal and Urinary Tract Cancer Mortality and Drinking Water Chlorination,
W79-05465 5C

Mutagenicity and Water Chlorination: Prospect and Perspective,
W79-05466 5C

The Mutagenic Activity of Halogenated Compounds Found in Chlorinated Drinking Water,
W79-05467 5C

Mutagenicity of Complex Mixtures from Drinking Water,
W79-05468 5C

A Priori Predictive Methods of Assessing Health Effects of Chemicals in the Environment,
W79-05469 5C

Development of Resistant Poliovirus by Repetitive Sublethal Exposure to Chlorine, ,
W79-05470 5C

Epidemic Problems and Chlorination of Drinking Water and Sewage in the Federal Republic of Germany,
W79-05471 5C

Risk Assessment of the Health Effects of Water Chlorination,
W79-05473 5C

Chlorination and Water Treatment for Minimizing Trihalomethanes in Drinking Water,
W79-05474 5C

Formation and Occurrence of Haloforms in Drinking Water in the Federal Republic of Germany,
W79-05475 5C

Ozone, Chlorine Dioxide and Chloramines as Alternatives to Chlorine for Disinfection of Drinking Water,
W79-05477 5C

Trihalomethane Formation from Iodine and Chlorine Disinfection of Ohio River Water,
W79-05479 5C

The Effect of Preozonation on Chloroform Production in the Chlorine Disinfection Process,
W79-05480 5C

Trihalomethane Reduction at the Louisville Water Company,
W79-05481 5C

Generation of Volatile Organic Compounds from Nonvolatile Precursors in Water by Treatment with Chlorine or Ozone,
W79-05482 5C

A Study of Alternatives to Chlorination for Disinfection of Wastewater,
W79-05483 5C

Bromine Chloride as an Alternative Wastewater Disinfectant to Chlorine,
W79-05484 5C

A Comparison of Bromine Chloride and Chlorine as Wastewater Disinfectants in Pilot Plant Studies,
W79-05485 5C

Chlorine Dioxide Destruction of Viruses and Bacteria in Water,
W79-05486 5C

Chlorine and Activated Carbon Treatment for Removal of Toxic Substances From Water,
W79-05487 5C

Chlorine Application for the Control of Condenser Fouling,
W79-05489 5C

A Kinetic Model for Predicting the Composition of Chlorinated Water Discharged from Power Plant Cooling Systems,
W79-05491 5C

Biofouling Control Alternatives to Chlorine for Power Plant Cooling Water Systems: An Overview,
W79-05492 5C

Bromine Chloride - An Alternative Biofouling Control Agent for Cooling Water Treatment,
W79-05493 5C

Evaluation of Alternative Chemical Treatments for Biofouling Control in Electric Power Facilities,
W79-05494 5C

CHLORINATION

Status of Regulation Development for Cooling Water Discharges from Power Plants,
W79-05495 5C

CHLORINE
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

CHLOROPHYTA
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

Productivity Studies on Baltic Macroalgae,
W79-05347 5C

CIRCULATION
Modeling Two-Dimensional Circulating Flow,
W79-05255 8B

CITIES
Results of a Preliminary Survey of Candidate Communities for Saline Water Demineralization Applications.
W79-05077 3A

CLAMMING
An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

CLAMS
Influence of Waste Residuals in Estuarine Waters on Development, Behavior and Survival of Soft-Shell Clam Larvae,
W79-05398 5C

CLASSIFICATION
Patterns of Photoassimilatory Products in Pacific Rhodophyceae,
W79-05328 5C

CLUSTER ANALYSIS
An Example of the Use of Factor Analysis and Cluster Analysis in Groundwater Chemistry Interpretation,
W79-05143 2F

COAGULATION
Fate of Metal Ions During Domestic Treatment of Water Containing Organics,
W79-05046 5F

COAL ASH
Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

COASTAL MARSHES
Algae of Saltmarshes on the South and Southwest Coasts of England,
W79-05335 5C

COBALT
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

COLD RESISTANCE
Predicting Effects of Cold Shock: Modeling the Decline of a Thermal Plume,
W79-05094 5B

Extreme Temperature Tolerance of Palaemon Serratus (Pennant): Influence of Size and Acclimation) Tolerance Aux Temperatures Extremes de Palaemon Serratus (Pennant): Influence de la Taille et de L'Acclimatation,
W79-05102 5C

COLIFORMS
Development and Evaluation of a Two-Step Membrane Filter Method for Fecal Coliform Recovery in Chlorinated Sewage Effluents,
W79-05012 5A

Detection of Enteroviruses and Bacterial Pathogens Surviving Standard Sewage Treatment,
W79-05090 5B

COLLECTIVE ACTION
Collective Decision Making in Water Resource Planning,
W79-05274 6A

COLORADO
Review of Design, Construction, and Operation of Mt. Elbert Forebay Dam and Reservoir Project, Colorado,
W79-05241 8A

Review of Design, Construction, and Operation of Crystal Dam Project, Colorado,
W79-05242 8A

Review of Design, Construction, and Operation of Pueblo Dam Project, Colorado,
W79-05243 8A

COLORADO RIVER
An Evaluation of the Status, Life History, and Habitat Requirements of the Endangered and Threatened Fishes of the Upper Colorado River System. Part Two,
W79-05114 5A

COLUMBIA RIVER
Dip Basket for Collecting Juvenile Salmon and Trout in Gatewells at Hydroelectric Dams,
W79-05175 5A

COMMUNICATION
A Conceptual Model of the Knowledge Transfer Process,
W79-05410 10D

COMPARISONS
Comparison Theorems for Gravity Waves in Basins of Variable Depth,
W79-05253 2H

COMPUTER MODELS
Development of a Hydrologic Model for a Canadian Watershed,
W79-05280 2A

Feasibility Study on Executive Program Development for Basin Ecosystem Modeling,
W79-05285 5G

A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

COMPUTER PROGRAMS
An Engineering Evaluation of the Electrodialysis Process Adapted for Computer Methods for Water Desalination Plants.
W79-05081 3A

Users Manual: Data Storage and Retrieval System for Pilot Wastewater Treatment Research,
W79-05281 7C

Feasibility Study on Executive Program Development for Basin Ecosystem Modeling,
W79-05285 5G

CONFERENCES
Water Chlorination: Environmental Impact and Health Effects.
W79-05435 5C

CONFINED WATER
Laterally Confined Flow from a Point Source at the Surface of an Inhomogeneous Soil Column,
W79-05261 2G

CONNECTICUT RIVER
Connecticut River Diversion: A Case Study in Water Allocation Policy,
W79-05414 6B

CONSERVATION
Effect of Process Water Recycle on Pollution Control and Energy Conservation,
W79-05422 3E

CONTINENTAL SHELF
Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

CONTROL
Control of Activated Sludge Bulking During Biological Purification (Regulirovanie prirosta aktivnogo ila pri biologicheskoi ochistke),
W79-05431 5D

CONTROL SYSTEMS
Control System for Irrigation Pumps,
W79-05373 3F

CONTROLS
Automatic Liquid Flow Control Device,
W79-05375 3F

CONVECTION
A Finite Element Method for the Diffusion-Convection Equation with Constant Coefficients,
W79-05019 5B

Some Aspects of Florida Convective Rainfall,
W79-05139 2B

Numerical Modeling of Liquid Geothermal Systems,
W79-05173 1A

CONVECTIVE RAINFALL
Some Aspects of Florida Convective Rainfall,
W79-05139 2B

COOLING WATER
Application of Phased Cooling to a Once-Through Cooling System,
W79-05227 5B

Rejection of Waste Heat from Power Plants Through Phased-Cooling,
W79-05228 5B

Process for Inhibiting Corrosion of Metals in Aqueous Systems,
W79-05391 5F

COPEPODS
Population Dynamics and Production of a Planktonic Marine Copepod, Acartia Clausii, in a Small Temperate Lagoon on San Juan Island, Washington,
W79-05346 5C

COPPER
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

Toxicity of Copper to Cutthroat Trout (Salmo Clarki) Under Different Conditions of Alkalinity, pH, and Hardness,
W79-05107 5A

The Riou-Mort a Tributary to the River Lot Polluted by Heavy Metals. I. Preliminary Observations on the Chemistry and Benthic Algae,
W79-05206 5B

COPPER COMPOUNDS
The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

COPPEROXYCHLORIDE
The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

CORROSION
Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

Controlling Iron Oxide Deposition in Boiler Systems,
W79-05498 3C

COST ANALYSIS
Distributing Regional Services Costs,
W79-05276 6C

A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

COST COMPARISONS
Automation of Surface Irrigation,
W79-05305 3F

COST DISTRIBUTION
Distributing Regional Services Costs,
W79-05276 6C

COST SHARING
Plan of Study: Case Studies of the Application of Cost Sharing Policy Options for Flood Plain Management in the Connecticut River Basin.
W79-05232 6F

COSTS
A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

Sludge to Land--Economic Considerations for Water Authorities,
W79-05320 6B

On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

Preliminary Design Study of an Optimum Nuclear Reactor-Saline Water Evaporator Process,
W79-05369 3A

COUNTING
Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

CRAYFISH
Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

CROP PRODUCTION
Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

CROP RESPONSE
Subsurface Drainage of an Alluvial Clay Soil for Soybeans,
W79-05053 4B

Reaction of Soybeans to Overflooding of Soil, (In Russian),
W79-05284 2I

Effect of Soil Humidity on Nitrate Reductase Activity in Barley Shoot Leaves (In Russian),
W79-05314 2I

Water Demand and Yield of Grain Crops in Cultivation Systems of Different Intensity, (In Russian),
W79-05336 2I

Application of Straw in Agriculture in the Arid Steppe Zone of the Northern Kazakh SSR (In Russian),
W79-05343 2G

Effects of Irrigation Methods on Water Exchange and Crop Capacity in Apple Tree (In Russian),
W79-05382 2I

CROPS
Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

Water Production Functions for Irrigated Agriculture,
W79-05275 3F

CRYSTAL DAM PROJECT (CO)
Review of Design, Construction, and Operation of Crystal Dam Project, Colorado,
W79-05242 8A

CRYSTAL GROWTH
Further Properties of Hydrates and Hydrating Agents.
W79-05089 3A

Solidification and Separation of Ice from Saline Water,
W79-05357 3A

The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-05368 3A

CRYSTALS
Radar Anisotropy of Sea Ice Due to Preferred Azimuthal Orientation of the Horizontal C Axes of Ice Crystals,
W79-05138 2C

CURRENTS (WATER)
Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

CUTTHROAT TROUT
Toxicity of Copper to Cutthroat Trout (Salmo Clarki) Under Different Conditions of Alkalinity, pH, and Hardness,
W79-05107 5A

CYANOPHYTA
Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

CYCLES
An Annual Phytoplankton Study in Coastal Waters Off Eastern Long Island (Block Island Sound),
W79-05231 5C

CYTOLOGICAL STUDIES
Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

DADE COUNTY
Biscayne Aquifer, Southeast Florida,
W79-05155 5B

DAIRY INDUSTRY
A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

DAM SAFETY
Review of Design, Construction, and Operation of Pueblo Dam Project, Colorado,
W79-05243 8A

DAMS
Dip Basket for Collecting Juvenile Salmon and Trout in Gatewells at Hydroelectric Dams,
W79-05175 5A

Review of Design, Construction, and Operation of Soldier Creek Dam Project, Utah.
W79-05239 8A

Review of Design, Construction, and Operation of Mountain Park Dam Project, Oklahoma,
W79-05240 8A

Review of Design, Construction, and Operation of Mt. Elbert Forebay Dam and Reservoir Project, Colorado,
W79-05241 8A

Review of Design, Construction, and Operation of Crystal Dam Project, Colorado,
W79-05242 8A

Review of Design, Construction, and Operation of Pueblo Dam Project, Colorado,
W79-05243 8A

Review of Design, Construction, and Operation of Ririe Dam Project, Idaho,
W79-05244 8A

Review of Design, Construction, and Operation of Nambe Falls Dam Project, New Mexico.
W79-05247 8A

DANUBE RIVER
Mixing Model for Large Streams,
W79-05133 5B

DATA ANALYSIS
A Water Demand and Wastewater Disposal Model for Optimum Transfer of Water Resources Technology in Developing Countries,
W79-05413 6D

DATA COLLECTIONS

DATA COLLECTIONS
The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume I.
W79-05014 2F

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

Nebraska Water Data Programs, 1978,
W79-05160 7C

7-Day Low Flows and Flow Duration of Alabama Streams Through 1973,
W79-05166 2E

Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

Urban Rainfall-Runoff-Quality Data Base,
W79-05282 2A

DBS
Effect of DBS Detergent on Activity of Some Enzymes of Young Carp (Cyprinus carpio L.) Brain, Gills and Serum,
W79-05177 5C

DDT
Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

DEBRIS AVALANCHES
Flood and Related Debris Flow Hazards Map,
W79-05165 7C

DECISION MAKING
Collective Decision Making in Water Resource Planning,
W79-05274 6A

DEDICATED TOWING SERVICE
A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

DEHYDROABIETIC ACID
Influence of Dilution Water on the Toxicity of Kraft Pulp and Paper Mill Effluent, Including Mechanisms of Effect,
W79-05105 5A

DEMINERALIZATION
Results of a Preliminary Survey of Candidate Communities for Saline Water Demineralization Applications.
W79-05077 3A

Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05365 3A

DEMOGRAPHY
Kennebec River Corridor Project -- Appendix I: Demography,
W79-05403 6B

DEMONSTRATION PLANT NO. 1
An Engineering Evaluation of the Long-Tube Vertical Falling-Film Distillation Process.
W79-05076 3A

DEMONSTRATION PLANT NO. 4
Brackish Water Conversion Demonstration Plant No. 4, Rosewell, New Mexico: Third Annual Report.
W79-05070 3A

DENSE NETWORK
Some Aspects of Florida Convective Rainfall,
W79-05139 2B

DENSITY
The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

DEPTH
Drainage Rates and Water-Table Depths,
W79-05137 2G

Effective Depth in Channels Having Bed Undulations,
W79-05254 2J

DESALINATION
Results of a Preliminary Survey of Candidate Communities for Saline Water Demineralization Applications.
W79-05077 3A

Third Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-05082 3A

Investigation and Preparation of Polymer Films to Improve the Separation of Water and Salts in Saline Water Conversion.
W79-05083 3A

Utilization of Isotopes for Saline Water Conversion.
W79-05084 3A

Research and Development of Processes for Desalting Water by Freezing,
W79-05085 3A

Solar Distillation of Sea Water in the Virgin Islands,
W79-05087 3A

Solidification and Separation of Ice from Saline Water,
W79-05357 3A

Economic and Technical Evaluation of the Wiped Film Evaporator,
W79-05358 3A

Thermodynamic Properties of Saline Water,
W79-05359 3A

Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

Investigation of Thermal Diffusion for Saline Water Conversion,
W79-05361 3A

Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

Development of a Direct-Freezing Continuous Wash-Separation Process for Saline Water Conversion,
W79-05364 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05365 3A

Absorption-Multistage Flash Distillation Process,
W79-05366 3A

Investigation of the Availability of Geothermal Energy for the Demineralization of Saline Water,
W79-05367 3A

Preliminary Design Study of an Optimum Nuclear Reactor-Saline Water Evaporator Process,
W79-05369 3A

Development of the Solvent Demineralization of Saline Water,
W79-05370 3A

Weathering Tests of Plastics and Design of Suspended Envelope Solar Stills,
W79-05371 3A

DESALINATION APPARATUS
Acid Mine Water Reverse Osmosis Test at Kittanning, Pennsylvania,
W79-05071 3A

Operation and Maintenance of 37,000 GPD Thin-Film Distillation Pilot Plant.
W79-05079 3A

Utilization of Isotopes for Saline Water Conversion.
W79-05084 3A

Demineralization of Saline Water with Solar Energy,
W79-05088 3A

Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

Development of a Direct-Freezing Continuous Wash-Separation Process for Saline Water Conversion,
W79-05364 3A

Development of the Solvent Demineralization of Saline Water,
W79-05370 3A

Weathering Tests of Plastics and Design of Suspended Envelope Solar Stills,
W79-05371 3A

DESALINATION PLANTS
Brackish Water Conversion Demonstration Plant No. 4, Rosewell, New Mexico: Third Annual Report.
W79-05070 3A

The Oak Ridge National Laboratory Conceptual Design of a 250-mgd Desalination Plant.
W79-05072 3A

A Study of Desalting Plants (15 to 150 MGD) and Nuclear Power Plants (200 to 1500 MWt) for Combined Water and Power Production.
W79-05075 3A

An Engineering Evaluation of the Long-Tube Vertical Falling-Film Distillation Process.
W79-05076 3A

Third Annual Report: Brackish Water Conversion Demonstration Plant, Webster, South Dakota.
W79-05078 3A

Operation and Maintenance of 37,000 GPD Thin-Film Distillation Pilot Plant.
W79-05079 3A

Research on and Analysis of Single-Effect Low Temperature Flash Evaporation Process.
W79-05080 3A

An Engineering Evaluation of the Electrodialysis Process Adapted for Computer Methods for Water Desalination Plants.
W79-05081 3A

Third Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-05082 3A

Economic and Technical Evaluation of the Wiped Film Evaporator,
W79-05358 3A

Parametric Cost Studies Pertaining to Dual-Purpose Power and Water Desalination Plants,
W79-05362 3A

Absorption-Multistage Flash Distillation Process,
W79-05366 3A

Preliminary Design Study of an Optimum Nuclear Reactor-Saline Water Evaporator Process,
W79-05369 3A

DESALINATION PROCESSES

Analysis and Optimization of a Reverse Osmosis Water Purification System,
W79-05073 3A

Cost Analysis of Six Water Desalting Processes,
W79-05074 3A

Third Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-05082 3A

Research and Development of Processes for Desalting Water by Freezing,
W79-05085 3A

Demineralization of Saline Water with Solar Energy,
W79-05088 3A

Economic and Technical Evaluation of the Wiped Film Evaporator,
W79-05358 3A

Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

Development of a Direct-Freezing Continuous Wash-Separation Process for Saline Water Conversion,
W79-05364 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05365 3A

Absorption-Multistage Flash Distillation Process,
W79-05366 3A

Investigation of the Availability of Geothermal Energy for the Demineralization of Saline Water,
W79-05367 3A

The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-05368 3A

Preliminary Design Study of an Optimum Nuclear Reactor-Saline Water Evaporator Process,
W79-05369 3A

Development of the Solvent Demineralization of Saline Water,
W79-05370 3A

DESIGN

An Engineering Evaluation of the Long-Tube Vertical Falling-Film Distillation Process.
W79-05076 3A

Review of Design, Construction, and Operation of Soldier Creek Dam Project, Utah.
W79-05239 8A

Review of Design, Construction, and Operation of Mountain Park Dam Project, Oklahoma,
W79-05240 8A

Review of Design, Construction, and Operation of Mt. Elbert Forebay Dam and Reservoir Project, Colorado,
W79-05241 8A

Review of Design, Construction, and Operation of Crystal Dam Project, Colorado,
W79-05242 8A

Review of Design, Construction, and Operation of Pueblo Dam Project, Colorado,
W79-05243 8A

Review of Design, Construction, and Operation of Ririe Dam Project, Idaho,
W79-05244 8A

Review of Design, Construction, and Operation of Nambe Falls Dam Project, New Mexico.
W79-05247 8A

DESIGN CRITERIA

The Oak Ridge National Laboratory Conceptual Design of a 250-mgd Desalination Plant.
W79-05072 3A

DESIGN CRTITERIA

Research on and Analysis of Single-Effect Low Temperature Flash Evaporation Process.
W79-05080 3A

DETENTION RESERVOIRS

Excavated Sediment Traps -- What Ralph Waldo Emerson was Really Talking About,
W79-05058 2J

Interactive Multiple Objective Optimization,
W79-05092 6A

DETERGENTS

Effect of DBS Detergent on Activity of Some Enzymes of Young Carp (Cyprinus carpio L.) Brain, Gills and Serum,
W79-05177 5C

Editorial Introduction,
W79-05188 5A

DEVELOPING COUNTRIES

A Multidisciplinary Transfer Model for Water Management Knowledge Transfer in Developing Countries,
W79-05411 6A

A Water Demand and Wastewater Disposal Model for Optimum Transfer of Water Resources Technology in Developing Countries,
W79-05413 6D

DIATOMS

Diatom Community Structure: Taxonomic and Statistical Analyses of a Mississippi Salt Marsh,
W79-05007 5C

Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

DICHLOBENIL

The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

DIFFERENTIAL MORTALITY

Transportation of Adult American Shad Past Dams on the Connecticut River, Massachusetts, 1973-76,
W79-05174 5C

DIFFUSION

A Finite Element Method for the Diffusion-Convection Equation with Constant Coefficients,
W79-05019 5B

Investigation of Thermal Diffusion for Saline Water Conversion,
W79-05361 3A

DIGENEASIDES

Patterns of Photoassimilatory Products in Pacific Rhodophyceae,
W79-05328 5C

DIPLOSOMA VIRENS

Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

DISCHARGE

Mobile Bay Hydrography Under Flood Stage Conditions,
W79-05008 2L

DISPERSION

A Finite Element Method for the Diffusion-Convection Equation with Constant Coefficients,
W79-05019 5B

Radial Dispersion to an Abstraction Well,
W79-05027 2F

Finite-Difference Solutions for One-Dimensional Dispersion Using an Improved Mesh Design,
W79-05028 2F

Predicting Dispersion Coefficients in Soils,
W79-05067 2G

DISSOLVED ORGANIC CARBON

Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

DISSOLVED ORGANIC NITROGEN

Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

DISSOLVED OXYGEN

Systematic Diurnal Curve Analysis,
W79-05042 5B

Predicting Nighttime Dissolved Oxygen Decline in Ponds Used for Tilapia Culture,
W79-05200 5B

Measurement of Dissolved Oxygen,
W79-05434 5A

DISSOLVED SOLIDS

Refiner Pulp Mill Effluent. Part 2. Composition of Dissolved Solids Fraction,
W79-05496 5B

DITHIZONE METHOD

Comparative Studies on Methods for Determining Total Mercury in Fish. Dithizone and Flameless Atomic Absorption Spectrophotometry Techniques,
W79-05183 5B

DIVERSION

Connecticut River Diversion: A Case Study in Water Allocation Policy,
W79-05414 6B

DOMESTIC WASTES
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

DOMINANT ORGANISMS
An Annual Phytoplankton Study in Coastal Waters Off Eastern Long Island (Block Island Sound),
W79-05231 5C

DRAINAGE
Estimating Design Flows for Urban Drainage,
W79-05024 2E

Drainage in a Natural Layered Profile by Finite Element Analysis,
W79-05051 2G

Drainage Rates and Water-Table Depths,
W79-05137 2G

DRAINAGE DENSITY
Drainage Density at Index of Watershed Development,
W79-05034 4A

DRAINAGE PATTERNS
Drainage Rates and Water-Table Depths,
W79-05137 2G

DRAINAGE PROGRAMS
Drainage Density at Index of Watershed Development,
W79-05034 4A

DRAKE PASSAGE
The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

DRAWDOWN
Annual Summary of Ground-Water Conditions in Arizona, Spring 1977 to Spring 1978,
W79-05151 4B

Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska,
W79-05161 4B

DROUGHT RESISTANCE
The Water State and Drought Resistance of Grapes in the Kopet-Dag Piedmont Subzone (In Russian),
W79-05342 2I

DROUGHT TOLERANCE
Growth Rhythms of Wheat Vegetative Organs and the Effect of Drought on Them (In Russian),
W79-05327 2I

DUNALIELLA
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

DYES
Microbial Degradation of Dye Wastes in Aqueous Effluents,
W79-05048 5D

ECOLOGY
An Annual Phytoplankton Study in Coastal Waters Off Eastern Long Island (Block Island Sound),
W79-05231 5C

Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

ECONOMIC GROWTH
Endogenous Bias in Technical Progress and Environmental Policy,
W79-05319 6B

ECONOMIC IMPACT
Economics of Irrigation,
W79-05292 3F

ECONOMICS
The German Federal Law on Wastewater Charges,
W79-05315 6E

An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

Endogenous Bias in Technical Progress and Environmental Policy,
W79-05319 6B

Sludge to Land--Economic Considerations for Water Authorities,
W79-05320 6B

ECOSYSTEMS
The MESA Puget Sound Project, Seattle, Washington. Fiscal year 1977 - Annual Report.
W79-05115 5C

EFFICIENCIES
Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

ELECTRIC POWER DEMAND
Electrical Load and Water Management,
W79-05290 3F

ELECTRIC POWERPLANTS
A Study of Desalting Plants (15 to 150 MGD) and Nuclear Power Plants (200 to 1500 MWt) for Combined Water and Power Production.
W79-05075 3A

ELECTRODIALYSIS
Third Annual Report: Brackish Water Conversion Demonstration Plant, Webster, South Dakota.
W79-05078 3A

An Engineering Evaluation of the Electrodialysis Process Adapted for Computer Methods for Water Desalination Plants.
W79-05081 3A

EMBRYONIC GROWTH STAGE
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05221 5C

ENDANGERED SPECIES
An Evaluation of the Status, Life History, and Habitat Requirements of the Endangered and Threatened Fishes of the Upper Colorado River System. Part Two,
W79-05114 5A

ENDOZOIC ORGANISMS
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

ENERGY
Effect of Process Water Recycle on Pollution Control and Energy Conservation,
W79-05422 3E

ENERGY TRANSFER
Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

ENGINEERING
An Engineering Evaluation of the Electrodialysis Process Adapted for Computer Methods for Water Desalination Plants.
W79-05081 3A

ENGLAND
Flow Resistance of Large-Scale Roughness,
W79-05141 2E

Algae of Saltmarshes on the South and Southwest Coasts of England,
W79-05335 5C

ENVIRONMENTAL CONTROL
Systems for Rapid Ranking of Environmental Pollutants. Selection of Subjects for Scientific and Technical Assessment Reports,
W79-05286 5A

ENVIRONMENTAL EFFECTS
Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forests Streams of Northern California,
W79-05005 5C

Drainage Density at Index of Watershed Development,
W79-05034 4A

The MESA Puget Sound Project, Seattle, Washington. Fiscal year 1977 - Annual Report.
W79-05115 5C

The Amoco Cadiz Oil Spill-Lines of Study and Early Observations,
W79-05189 5A

Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development,
W79-05212 5C

Coastal Morphology, Oil Spill Vulnerability and Sedimentology of Kotzebue Sound and Kodiak Island,
W79-05213 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

Mitigating Adverse Environmental Effects of Highway Construction.
W79-05235 6G

Interdisciplinary Team Approach to Mitigating Adverse Environmental Impacts of Highway Construction,
W79-05236 6G

Silt Barriers as Erosion Pollution Control in a Large Recreational Lake,
W79-05237 4D

Endogenous Bias in Technical Progress and Environmental Policy,
W79-05319 6B

Natural and Model Aquatic Humics: Reactions with Chlorine,
W79-05437 5C

A Program to Introduce Site-Specific Chlorination Regimes at Ontario Hydro Generating Stations,
W79-05442 5C

A Preliminary Look at the Effects of Intermittent Chlorination on Selected Warmwater Fishes,
W79-05443 5C

Toward an Understanding of the Toxicity of Intermittent Exposures of Total Residual Chlorine to Freshwater Fishes,
W79-05444 5C

Influence of Chlorine Form and Ambient Temperature on the Toxicity of Intermittent Chlorination to Freshwater Fish,
W79-05445 5C

The Use of Various Avoidance Indices to Evaluate the Behavioral Response of the Golden Shiner to Components of Total Residual Chlorine,
W79-05446 5C

Avoidance of Monochloramine: Test Tank Results for Rainbow Trout, Coho Salmon, Alewife, Yellow Perch and Spottail Shiner,
W79-05447 5C

Investigation of the Effects of Halogenated Organic Compounds Produced in Cooling Systems and Process Effluents on Aquatic Organisms,
W79-05448 5C

Brominated Compounds Found in Waste-Treatment Effluents and Their Capacity to Bioaccumulate,
W79-05449 5C

Biological and Chemical Effects of Chlorination at Coastal Power Plants,
W79-05456 5C

Seasonal Chronic Toxicity of Chlorination to the American Oyster, Crassotrea Virginica (G),
W79-05458 5C

Effects of Chlorinated Sea Water on Decapod Crustaceans,
W79-05459 5C

The Relative Sensitivity of Pacific Northwest Fishes and Invertebrates to Chlorinated Sea Water,
W79-05460 5C

Respiratory and Osmoregulatory Responses of White Perch (Morone Americana) Exposed to Chlorine and Ozone in Estuarine Waters,
W79-05461 5C

Continuous Low-Level Chlorination for Marine Fouling Control at Power Stations in the United Kingdom,
W79-05462 5C

Response of Entrained Plankton to Low-Level Chlorination at a Coastal Power Station,
W79-05463 5C

A Case Control Study of Gastrointestinal and Urinary Tract Cancer Mortality and Drinking Water Chlorination,
W79-05465 5C

Worldwide Aspects of Water Chlorination,
W79-05472 5C

Risk Assessment of the Health Effects of Water Chlorination,
W79-05473 5C

A Study of Alternatives to Chlorination for Disinfection of Wastewater,
W79-05483 5C

Bromine Chloride as an Alternative Wastewater Disinfectant to Chlorine,
W79-05484 5C

A Comparison of Bromine Chloride and Chlorine as Wastewater Disinfectants in Pilot Plant Studies,
W79-05485 5C

Chlorine Application for the Control of Condenser Fouling,
W79-05489 5C

Bromine Chloride - An Alternative Biofouling Control Agent for Cooling Water Treatment,
W79-05493 5C

Evaluation of Alternative Chemical Treatments for Biofouling Control in Electric Power Facilities,
W79-05494 5C

Status of Regulation Development for Cooling Water Discharges from Power Plants,
W79-05495 5C

ENVIRONMENTAL POLICY

Endogenous Bias in Technical Progress and Environmental Policy,
W79-05319 6B

ENZYMES

Effect of DBS Detergent on Activity of Some Enzymes of Young Carp (Cyprinus carpio L.) Brain, Gills and Serum,
W79-05177 5C

Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

EPIDEMIOLOGY

The Epidemiologic Approach to the Evaluation of Organics in Drinking Water,
W79-05464 5C

EPIPHYTES

Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

EQUATIONS

Distributed Sources for Unconfined Groundwater Flow in a Half-Space,
W79-05025 2F

EQUILIBRIUM

Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

EROSION

Wear of Unsound Pebbles in River Headwaters,
W79-05016 2J

Summary of Watershed Conditions in the Vicinity of Redwood National Park, California,
W79-05170 4D

Mitigating Adverse Environmental Effects of Highway Construction.
W79-05235 6G

Influence of Row Spacing of Grain Sorghum on Ground Cover, Runoff, and Erosion,
W79-05258 3F

EROSION CONTROL

Summary of Watershed Conditions in the Vicinity of Redwood National Park, California,
W79-05170 4D

Silt Barriers as Erosion Pollution Control in a Large Recreational Lake,
W79-05237 4D

EROSION RATES

Reconnaissance Assessment of Erosion and Sedimentation in the Canada De Los Alamos Basin, Los Angeles and Ventura Counties, California,
W79-05172 2J

ESTIMATED COSTS

Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

ESTRADIOL-17BETA

On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

ESTUARIES

Algae of Saltmarshes on the South and Southwest Coasts of England,
W79-05335 5C

Dissolved Glucose in a Bayou Estuary, Possible Sources and Utilization by Bacteria,
W79-05397 5C

Influence of Waste Residuals in Estuarine Waters on Development, Behavior and Survival of Soft-Shell Clam Larvae,
W79-05398 5C

ESTUARINE ENVIRONMENTS

Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

ETHANOL

Behavioral Toxicology and Teleost Fish,
W79-05100 5C

EUPHAUSIA

Effect of Thermal Increases of Short Duration on Survival of Euphausia Pacifica,
W79-05101 5C

EUPHAUSIIDS

Effect of Thermal Increases of Short Duration on Survival of Euphausia Pacifica,
W79-05101 5C

EUPHOTIC ZONE

The Influence of Turbidity on Net Phytoplankton Photosynthesis in Some Irish Lakes,
W79-05098 5C

EUPLANKTON

Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

EUTROPHICATION

Algae and Water Pollution,
W79-05322 5C

The Phytoplankton Characteristics of the Barrier Island Lagoons of the Gulf of California,
W79-05337 5C

Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

Community Production and Respiration by Ciliated Protozoa in the Benthos of a Small Eutrophic Loch,
W79-05354 5C

EVALUATION

An Engineering Evaluation of the Long-Tube Vertical Falling-Film Distillation Process.
W79-05076 3A

Third Annual Report: Brackish Water Conversion Demonstration Plant, Webster, South Dakota.
W79-05078 3A

Research on and Analysis of Single-Effect Low Temperature Flash Evaporation Process.
W79-05080 3A

An Engineering Evaluation of the Electrodialysis Process Adapted for Computer Methods for Water Desalination Plants.
W79-05081 3A

Review of Design, Construction, and Operation of Soldier Creek Dam Project, Utah.
W79-05239 8A

Review of Design, Construction, and Operation of Mountain Park Dam Project, Oklahoma,
W79-05240 8A

Review of Design, Construction, and Operation of Mt. Elbert Forebay Dam and Reservoir Project, Colorado,
W79-05241 8A

Review of Design, Construction, and Operation of Crystal Dam Project, Colorado,
W79-05242 8A

Review of Design, Construction, and Operation of Pueblo Dam Project, Colorado,
W79-05243 8A

Review of Design, Construction, and Operation of Ririe Dam Project, Idaho,
W79-05244 8A

Review of Design, Construction, and Operation of Nambe Falls Dam Project, New Mexico.
W79-05247 8A

FACTOR ANALYSIS

An Example of the Use of Factor Analysis and Cluster Analysis in Groundwater Chemistry Interpretation,
W79-05143 2F

FARM MANAGEMENT

Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

FARM PONDS

Predicting Nighttime Dissolved Oxygen Decline in Ponds Used for Tilapia Culture,
W79-05200 5B

FEASIBILITY STUDIES

Feasibility Study on Executive Program Development for Basin Ecosystem Modeling,
W79-05285 5G

FEDERAL GOVERNMENT

The Federal Ground-Water Protection Program--A Review,
W79-05127 5G

The Federal Ground-Water Protection Program--Today's Hope,
W79-05128 5G

FERTILIZATION

Plant Nutrient Losses from Foliar-Fertilized Soybeans,
W79-05056 5G

FILTRATION

Fate of Metal Ions During Domestic Treatment of Water Containing Organics,
W79-05046 5F

FISH

A Preliminary Look at the Effects of Intermittent Chlorination on Selected Warmwater Fishes,
W79-05443 5C

Toward an Understanding of the Toxicity of Intermittent Exposures of Total Residual Chlorine to Freshwater Fishes,
W79-05444 5C

FISH BARRIERS

Conceptual Review and Preliminary Design of Multifarious Water Intake Structures,
W79-05248 8A

FISH BEHAVIOR

Behavioral Toxicology and Teleost Fish,
W79-05100 5C

FISH CULTURE

Announcement of Compounds Registered for Fishery Uses,
W79-05205 5A

FISH DISEASES

Pollution-Associated Diseases and Abnormalities of Fish and Shellfish: A Review,
W79-05097 5C

Announcement of Compounds Registered for Fishery Uses,
W79-05205 5A

FISH EGGS

Effect of Phenol Upon Activation and Fertilization Ability of Rainbow Trout Spermatozoa (Salmo Gairdneri Rich.) (In Polish),
W79-05176 5C

Hatching Table for Fisheries Research,
W79-05178 5A

FISH FARMING

Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

FISH FOOD ORGANISMS

Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

FISH GUIDING

Conceptual Review and Preliminary Design of Multifarious Water Intake Structures,
W79-05248 8A

FISH MIGRATION

Ecological Observation on the Adult Salmon: I. Diurnal Variation of Upstream Migration of the Adult Chum Salmon in the Chitose River (In Japanese),
W79-05348 6G

FISH PARASITES

The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

FISH POPULATIONS

The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

An Evaluation of the Status, Life History, and Habitat Requirements of the Endangered and Threatened Fishes of the Upper Colorado River System. Part Two,
W79-05114 5A

Changes in the Species Composition of Fish in the River Lot,
W79-05184 5B

FISH REPRODUCTION

Effect of Phenol Upon Activation and Fertilization Ability of Rainbow Trout Spermatozoa (Salmo Gairdneri Rich.) (In Polish),
W79-05176 5C

Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

FISH TOXICANT

Announcement of Compounds Registered for Fishery Uses,
W79-05205 5A

FISH TRANSPORT

Transportation of Adult American Shad Past Dams on the Connecticut River, Massachusetts, 1973-76,
W79-05174 5C

FJORDS

Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

FLASH DISTILLATION

Preliminary Design Study of an Optimum Nuclear Reactor-Saline Water Evaporator Process,
W79-05369 3A

FLOOD CONTROL

Plan of Study: Case Studies of the Application of Cost Sharing Policy Options for Flood Plain Management in the Connecticut River Basin.
W79-05232 6F

Flood-Plain Management in Dallas, Tex.: 1908-1978,
W79-05272 6F

Kennebec River Corridor Project -- Appendix IV: Flooding,
W79-05406 6B

FLOOD-DEBRIS HAZARD ZONE

Flood and Related Debris Flow Hazards Map,
W79-05165 7C

FLOOD FORECASTING

A Simple Version of Gumbel's Method for Flood Estimation,
W79-05256 2E

FLOOD FREQUENCY

Relationship Between Alluvial Soils and Flooding in the Piedmont Lowland of Southeastern Pennsylvania,
W79-05017 2E

Flood Hazard Analyses: Little Catoctin Creek and Tributaries, Frederick County, Maryland.
W79-05246 2E

FLOOD HAZARD MAPS

Flood Hazard Analyses: Little Catoctin Creek and Tributaries, Frederick County, Maryland.
W79-05246 2E

FLOOD PLAIN ZONING

Flood Hazard Analyses: Little Catoctin Creek and Tributaries, Frederick County, Maryland.
W79-05246 2E

FLOOD PLAINS

Flood and Related Debris Flow Hazards Map,
W79-05165 7C

Flood-Plain Management in Dallas, Tex.: 1908-1978,
W79-05272 6F

FLOOD PROFILES
Flood Hazard Analyses: Little Catoctin Creek and Tributaries, Frederick County, Maryland.
W79-05246 2E

FLOOD PROTECTION
Kennebec River Corridor Project -- Appendix IV: Flooding,
W79-05406 6B

FLOOD STAGES
Mobile Bay Hydrography Under Flood Stage Conditions,
W79-05008 2L

FLOODING
Reaction of Soybeans to Overflooding of Soil, (In Russian),
W79-05284 2I

FLOODS
Relationship Between Alluvial Soils and Flooding in the Piedmont Lowland of Southeastern Pennsylvania,
W79-05017 2E

Flood and Related Debris Flow Hazards Map,
W79-05165 7C

A Simple Version of Gumbel's Method for Flood Estimation,
W79-05256 2E

FLOODWAYS
Flood-Plain Management in Dallas, Tex.: 1908-1978,
W79-05272 6F

FLORIDA
Drainage Density at Index of Watershed Development,
W79-05034 4A

Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

Some Aspects of Florida Convective Rainfall,
W79-05139 2B

Silt Barriers as Erosion Pollution Control in a Large Recreational Lake,
W79-05237 4D

FLORIDOSIDES
Patterns of Photoassimilatory Products in Pacific Rhodophyceae,
W79-05328 5C

FLOW
Behaviour of a Hydrodynamic Finite Element Model,
W79-05020 8B

Modeling Two-Dimensional Circulating Flow,
W79-05255 8B

Flow Measurement,
W79-05388 4A

FLOW CONTROL
Automatic Liquid Flow Control Device,
W79-05375 3F

Kennebec River Corridor Project -- Appendix III: Flow Regulation,
W79-05405 6B

FLOW MEASUREMENT
Flow Measurement,
W79-05388 4A

FLOW RATES
Simulated Flow Rate Requirements for Some Flushing Emitters,
W79-05062 8B

FLOW RESISTANCE
Flow Resistance of Large-Scale Roughness,
W79-05141 2E

FLUID FLOW
Modeling Two-Dimensional Circulating Flow,
W79-05255 8B

FLUID FRICTION
A Time-Dependent Model of a Coastal Boundary Layer with Friction,
W79-05263 2H

FLY ASH
Wastewater Treatment with Humic Acid-Fly Ash Mixtures,
W79-05006 5D

FOLIAR APPLICATION
Plant Nutrient Losses from Foliar-Fertilized Soybeans,
W79-05056 5G

FOOD CHAINS
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

FOOD HABITS
Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

FORCED CIRCULATION VAPOR COMPRESSION DISTILLATION
Brackish Water Conversion Demonstration Plant No. 4, Rosewell, New Mexico: Third Annual Report.
W79-05070 3A

FORECASTING
A Water Demand and Wastewater Disposal Model for Optimum Transfer of Water Resources Technology in Developing Countries,
W79-05413 6D

FOREST WATERSHEDS
Simulated Streamflow Response to Possible Differences in Transpiration Among Species of Hardwood Trees,
W79-05018 2A

FORESTRY
Non-Point Water Quality Modeling in Wildland Management: A State-of-The-Art Assessment. (Volume I. Text).
W79-05269 5C

Non-Point Water Quality Modeling in Wildland Management: A State-of-the-Art Assessment (Volume II - Appendixes).
W79-05270 5G

FORESTS
The Development of Overland Flow in a Tropical Rainforest Catchment,
W79-05030 2A

FOSSIL FUELS
A Study of Desalting Plants (15 to 150 MGD) and Nuclear Power Plants (200 to 1500 MWt) for Combined Water and Power Production.
W79-05075 3A

Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

FRAGMENTATION
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

FRANCE
Obtaining Variations of Field Infiltration Capacity from Simulated Rainstorm Experiments (Determination Des Variations De La Capacite D'Absorption D'Un Sol En Place Sous Averses Simulees),
W79-05257 2G

Control of Oil Pollution by Remote Sensing Along the Shores of France,
W79-05392 7B

FREDERICK COUNTY (MD)
Flood Hazard Analyses: Little Catoctin Creek and Tributaries, Frederick County, Maryland.
W79-05246 2E

FREEZING
Research and Development of Processes for Desalting Water by Freezing,
W79-05085 3A

Solidification and Separation of Ice from Saline Water,
W79-05357 3A

Development of a Direct-Freezing Continuous Wash-Separation Process for Saline Water Conversion,
W79-05364 3A

FREQUENCY
Internal Waves in a Circular Channel,
W79-05250 2H

Comparison Theorems for Gravity Waves in Basins of Variable Depth,
W79-05253 2H

FRESHWATER FISH
Rapid Vacuum Method for Removal of Mucus from the Epidermis of Fishes,
W79-05180 5A

FROGS
Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

FROST PROTECTION
The Use of Overtree Irrigation for Crop Cooling and Frost and Freeze Protection on Apples,
W79-05298 3F

FROZEN SOILS
The Applicability of Dual Gamma Scanning to Freezing Soils and the Problem of Stratification,
W79-05260 2C

FRYINGPAN-ARKANSAS PROJECT
Review of Design, Construction, and Operation of Mt. Elbert Forebay Dam and Reservoir Project, Colorado,
W79-05241 8A

FULVIC ACIDS
Fate of Metal Ions During Domestic Treatment of Water Containing Organics,
W79-05046 5F

FURROW IRRIGATION
Water Efficiency with Deficit and Suboptimal Irrigation,
W79-05302 3F

GAMMA RAYS
Errors in Gamma-Ray Measurements of Water Content and Bulk Density in Nonuniform Soils,
W79-05251 2G

GAS BUBBLE DISEASE
Survival of Salmon Smolts in Sea Water After Exposure to Air-Supersaturated Water,
W79-05191 5B

GATEWELLS
Dip Basket for Collecting Juvenile Salmon and Trout in Gatewells at Hydroelectric Dams,
W79-05175 5A

GENERAL TOWING SERVICE
A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

GEOGRAPHICAL REGIONS
The World Remote Sensing Index, A Comprehensive Geographic Index Bibliography to Remote Sensing Site Investigations of Natural and Agricultural Resources Throughout the World,
W79-05119 7B

GEOLOGY
The United States Geological Survey in Alaska: Accomplishments During 1977.
W79-05167 7C

GEOTHERMAL STUDIES
Numerical Modeling of Liquid Geothermal Systems,
W79-05173 1A

Investigation of the Availability of Geothermal Energy for the Demineralization of Saline Water,
W79-05367 3A

GHYBEN-HERZBERG LENS
Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

GILLS
Histopathological Changes in the Fish After Intoxication with Non-Ionogenic Tensides on the Basis of Ethoxyl Aducts of Isononylphenols (Histopatologicke Zmeny u Ryb Po Intoxikaci Neionogennimi Tenzidy na Bazi Ethoxylovych Aduktu Isononylfenolu),
W79-05099 5C

GLUCOSE
Dissolved Glucose in a Bayou Estuary, Possible Sources and Utilization by Bacteria,
W79-05397 5C

GRAIN SORGHUM
Influence of Row Spacing of Grain Sorghum on Ground Cover, Runoff, and Erosion,
W79-05258 3F

GRAPES
The Water State and Drought Resistance of Grapes in the Kopet-Dag Piedmont Subzone (In Russian),
W79-05342 2I

GRASSES
Better Grasses for Roadsides,
W79-05238 6G

GREAT LAKES
A Time-Dependent Model of a Coastal Boundary Layer with Friction,
W79-05263 2H

GREENBELT FARM (ONTARIO
Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

GROUNDWATER
Radial Dispersion to an Abstraction Well,
W79-05027 2F

Finite-Difference Solutions for One-Dimensional Dispersion Using an Improved Mesh Design,
W79-05028 2F

Ground-Water Pollution--A Status Report,
W79-05120 5C

Ground-Water Pollution--An Imminent Disaster,
W79-05121 5C

Ground-Water Pollution--A Limited Problem,
W79-05122 5B

Ground-Water Quality Standards--A Neutral View,
W79-05123 5B

Ground-Water Quality Standards--Relevant,
W79-05124 5B

Ground-Water Quality Standards--Irrelevant,
W79-05125 5B

Land Application of Waste--An Accident Waiting to Happen,
W79-05126 5B

The Federal Ground-Water Protection Program--A Review,
W79-05127 5G

The Federal Ground-Water Protection Program--Today's Hope,
W79-05128 5G

The Federal Ground-Water Protection Program--Tomorrow's Undoing,
W79-05129 5G

State Ground-Water Protection Programs--A National Summary,
W79-05130 5G

State Ground-Water Protection Programs--Inadequate,
W79-05131 5G

State Ground-Water Protection Programs--Adequate,
W79-05132 5G

An Example of the Use of Factor Analysis and Cluster Analysis in Groundwater Chemistry Interpretation,
W79-05143 2F

Annual Summary of Ground-Water Conditions in Arizona, Spring 1977 to Spring 1978,
W79-05151 4B

Water Resources Data for Montana, Water Year 1977,
W79-05162 7C

GROUNDWATER AVAILABILITY
Summary Appraisals of the Nation's Ground-Water Resources--Alaska,
W79-05153 2F

Summary Appraisals of the Nation's Ground-Water Resources--South Atlantic-Gulf Region,
W79-05154 2F

GROUNDWATER DEVELOPMENT
Defining Upper Limits to Groundwater Development in the Arid West,
W79-05271 4B

GROUNDWATER MINING
Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska,
W79-05161 4B

GROUNDWATER MOVEMENT
Distributed Sources for Unconfined Groundwater Flow in a Half-Space,
W79-05025 2F

Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

Biscayne Aquifer, Southeast Florida,
W79-05155 5B

GROUNDWATER RECHARGE
Artificial Recharge on Long Island, New York,
W79-05169 4B

GROUNDWATER RESOURCES
The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume I.
W79-05014 2F

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

Groundwater Levels in Nebraska, 1977,
W79-05150 2F

Summary Appraisals of the Nation's Ground-Water Resources--Missouri Basin Region,
W79-05152 7C

Summary Appraisals of the Nation's Ground-Water Resources--Alaska,
W79-05153 2F

Summary Appraisals of the Nation's Ground-Water Resources--South Atlantic-Gulf Region,
W79-05154 2F

GROUNDWOOD MILLS
Refiner Pulp Mill Effluent. Part 2. Composition of Dissolved Solids Fraction,
W79-05496 5B

GROWTH RATES
Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

GULF OF CALIFORNIA (MEXICO)
The Phytoplankton Characteristics of the Barrier Island Lagoons of the Gulf of California,
W79-05337 5C

GUMBEL'S METHOD
A Simple Version of Gumbel's Method for Flood Estimation,
W79-05256 2E

HARBORS
Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

HASKELL COUNTY (TX)
The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume I.
W79-05014 2F

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

HASTINGS LAKE (ALBERTA
Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

HAZARDS
Image Enhancement of Side-Scan Sonar Mapping,
W79-05395 7B

HCH
Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

HEAT RESISTANCE
Effect of Thermal Increases of Short Duration on Survival of Euphausia Pacifica,
W79-05101 5C

Extreme Temperature Tolerance of Palaemon Serratus (Pennant): Influence of Size and Acclimation) Tolerance Aux Temperatures Extremes de Palaemon Serratus (Pennant): Influence de la Taille et de L'Acclimatation,
W79-05102 5C

Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

HEAT TRANSFER COEFFICIENTS
Computer Simulation of Bubbler-Induced Melting of Ice Covers Using Experimental Heat Transfer Results,
W79-05279 2C

HEATED WATER
Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

HEAVY METALS
Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

Heavy Metal Concentrations at the Apex of the New York Bight,
W79-05117 5A

Distribution and Dynamics of Heavy Metals in Alaskan Shelf Environments Subject to Oil Development,
W79-05219 5C

Kansas River Limnology: Seasonal Variations in Photosynthetic Production and Heavy Metal Accumulation by Aquatic Insects,
W79-05234 5C

Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

HERBICIDE WASHOFF
Washoff of Herbicides Applied to Corn Residue,
W79-05036 5B

HERBICIDES
Washoff of Herbicides Applied to Corn Residue,
W79-05036 5B

HERBIVORES
Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

HETEROGENEITY
Laterally Confined Flow from a Point Source at the Surface of an Inhomogeneous Soil Column,
W79-05261 2G

HETEROTROPHY
Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

HIGHWAYS
Mitigating Adverse Environmental Effects of Highway Construction.
W79-05235 6G

Interdisciplinary Team Approach to Mitigating Adverse Environmental Impacts of Highway Construction,
W79-05236 6G

Silt Barriers as Erosion Pollution Control in a Large Recreational Lake,
W79-05237 4D

Better Grasses for Roadsides,
W79-05238 6G

HOLYOKE DAM
Transportation of Adult American Shad Past Dams on the Connecticut River, Massachusetts, 1973-76,
W79-05174 5C

HOT SPRINGS
Numerical Modeling of Liquid Geothermal Systems,
W79-05173 1A

HUDSON SHELF VALLEY
Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

HUMIC ACID
Wastewater Treatment with Humic Acid-Fly Ash Mixtures,
W79-05006 5D

HUMID AREAS
Trickle Irrigation in Humid Zones,
W79-05311 3F

HUMID CLIMATEES
Factors Influencing System Selection in Humid Regions,
W79-05297 3F

HYDRATE PROCESSES
Further Properties of Hydrates and Hydrating Agents.
W79-05089 3A

The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-05368 3A

HYDRATES
Further Properties of Hydrates and Hydrating Agents.
W79-05089 3A

HYDRATION
The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-05368 3A

HYDRAULIC CONDUCTIVITY
Variability of Soil Water Retention Curves and Predicted Hydraulic Conductivities on a Small Plot,
W79-05136 2G

HYDRAULIC DESIGN
Review of Design, Construction, and Operation of Pueblo Dam Project, Colorado,
W79-05243 8A

HYDRAULIC JUMP
The Growth and Decay of a Hydraulic Jump,
W79-05146 8B

HYDRAULIC MODELS
A Model Study of St. Marys River Ice Navigation,
W79-05278 2C

HYDRAULIC STRUCTURES
Review of Design, Construction, and Operation of Soldier Creek Dam Project, Utah.
W79-05239 8A

Review of Design, Construction, and Operation of Mountain Park Dam Project, Oklahoma,
W79-05240 8A

Review of Design, Construction, and Operation of Mt. Elbert Forebay Dam and Reservoir Project, Colorado,
W79-05241 8A

Review of Design, Construction, and Operation of Crystal Dam Project, Colorado,
W79-05242 8A

Review of Design, Construction, and Operation of Pueblo Dam Project, Colorado,
W79-05243 8A

Review of Design, Construction, and Operation of Ririe Dam Project, Idaho,
W79-05244 8A

Review of Design, Construction, and Operation of Nambe Falls Dam Project, New Mexico.
W79-05247 8A

Conceptual Review and Preliminary Design of Multifarious Water Intake Structures,
W79-05248 8A

HYDRODYNAMICS
Behaviour of a Hydrodynamic Finite Element Model,
W79-05020 8B

HYDROGEN ION CONCENTRATION
Influence of Dilution Water on the Toxicity of Kraft Pulp and Paper Mill Effluent, Including Mechanisms of Effect,
W79-05105 5A

Evaluation of pH Shock on Hatchery-Reared Rainbow Trout,
W79-05202 5C

HYDROGEOLOGY
Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

Ground-Water Pollution--A Status Report,
W79-05120 5C

Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado, 1975-76,
W79-05164 2F

HYDROLOGIC DATA
Water Resources Data for Montana, Water Year 1977,
W79-05162 7C

Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado, 1975-76,
W79-05164 2F

HYDROLOGY
The United States Geological Survey in Alaska: Accomplishments During 1977.
W79-05167 7C

HYDROTHERMAL SYSTEMS
Numerical Modeling of Liquid Geothermal Systems,
W79-05173 1A

HYPNOSPORES
Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

ICE-BRINE SYSTEMS
Solidification and Separation of Ice from Saline Water,
W79-05357 3A

ICE COVER
A Model Study of St. Marys River Ice Navigation,
W79-05278 2C

Computer Simulation of Bubbler-Induced Melting of Ice Covers Using Experimental Heat Transfer Results,
W79-05279 2C

ICE-WATER INTERFACES
Solidification and Separation of Ice from Saline Water,
W79-05357 3A

IDAHO
Sediment Characteristics and Transport from Northwest Rangeland Watersheds,
W79-05035 2J

Review of Design, Construction, and Operation of Ririe Dam Project, Idaho,
W79-05244 8A

IDENTIFICATION KEYS
Algae and Water Pollution,
W79-05322 5C

ILLINOIS
Record Winter Storms in Illinois, 1977-1978,
W79-05013 2B

IMPOUNDMENTS
Mathematical Modeling of Surface Water Impoundments, Volume: I, and II,
W79-05011 2H

Sedimentation Modeling of Impoundment Terraces,
W79-05039 2J

Characteristics of Pennsylvania Recreational Lakes,
W79-05168 2H

INDONESIA
Survey on Sesayap River as Possible Water Resource for a Pulp and Paper Mill (In Indonesia) (Survai sungai Sesayap dan kemungkinannya sebagai sumber air untrk pabrik pulp dan kertas),
W79-05427 6D

INDUSTRIAL WASTES
Process for Phosphate Conversion Coating with Treatment of Rinse Water by Reverse Osmosis and Ion Exchange,
W79-05372 5D

Treatment of Effluents,
W79-05385 5D

INDUSTRIAL WATER
Process for Phosphate Conversion Coating with Treatment of Rinse Water by Reverse Osmosis and Ion Exchange,
W79-05372 5D

Process for Inhibiting Corrosion of Metals in Aqueous Systems,
W79-05391 5F

INFILTRATION
Runoff Curve Numbers with Varying Site Moisture,
W79-05023 2D

Influence of Soil Air and Drainage on Infiltration,
W79-05054 2G

Obtaining Variations of Field Infiltration Capacity from Simulated Rainstorm Experiments (Determination Des Variations De La Capacite D'Absorption D'Un Sol En Place Sous Averses Simulees),
W79-05257 2G

Laterally Confined Flow from a Point Source at the Surface of an Inhomogeneous Soil Column,
W79-05261 2G

INFILTRATION RATES
A Simple Finite Element Method of Infiltration,
W79-05064 2G

INFLOW
Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

INFORMATION DISSEMINATION
Water Knowledge Transfer: Proceedings, Second International Conference on Transfer of Water Resources Knowledge, June 1977, Fort Collins, Colo.,
W79-05409 10D

INFORMATION TRANSFER
A Conceptual Model of the Knowledge Transfer Process,
W79-05410 10D

INJECTION WELLS
Artificial Recharge on Long Island, New York,
W79-05169 4B

INSECTICIDES
Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

INSTITUTIONS
Institutional Arrangements for Effective Water Management in Colorado,
W79-05049 6E

INTAKE STRUCTURES
Conceptual Review and Preliminary Design of Multifarious Water Intake Structures,
W79-05248 8A

INTERACTIVE GRAPHIC DISPLAY
Feasibility Study on Executive Program Development for Basin Ecosystem Modeling,
W79-05285 5G

INVERTEBRATES
Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forests Streams of Northern California,
W79-05005 5C

IRAN
A Non-Linear Optimization Method for the Estimation of Aquifer Parameters,
W79-05026 2F

IRAQ
A Simple Version of Gumbel's Method for Flood Estimation,
W79-05256 2E

IRON OXIDES
Controlling Iron Oxide Deposition in Boiler Systems,
W79-05498 3C

IRRIGATED LAND
Transient Subsurface Drainage on Sloping Irrigated Land,
W79-05052 6A

IRRIGATION
Water Production Functions for Irrigated Agriculture,
W79-05275 3F

A Solar-Powered Pump for Irrigation,
W79-05287 3F

Energy and Irrigation,
W79-05288 3F

Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

Spray Nozzle,
W79-05374 3F

Automatic Liquid Flow Control Device,
W79-05375 3F

Wind Correction Method and Apparatus for Irrigation Systems,
W79-05379 3F

Water Drive System for a Center Pivot Irrigation Unit or the Like,
W79-05387 3F

Irrigation Apparatus,
W79-05389 3F

IRRIGATION DESIGN
Pressure Losses Across Trickle Irrigation Fittings and Emitters,
W79-05060 8B

IRRIGATION EFFECTS
Reducing Stream Sediment Loads by Irrigation Diversions,
W79-05057 2J

Dynamic Changes in pH and Composition of Absorbed Cations in Irrigated Chernozems of the Trans-Volga Area (In Russian),
W79-05226 2K

Effects of Irrigation Methods on Water Exchange and Crop Capacity in Apple Tree (In Russian),
W79-05382 2I

IRRIGATION EFFICIENCY
Introduction to Irrigation Efficiency and Scheduling,
W79-05300 3F

Comparative Efficiency of Irrigation Systems,
W79-05303 3F

Measuring Efficiency of Surface Irrigation Systems,
W79-05307 3F

Control System for Irrigation Pumps,
W79-05373 3F

IRRIGATION PRACTICE
Scheduling of Water and Nitrogen for Corn in the Humid Midwest,
W79-05295 3F

IRRIGATION PRACTICES
Societal Attitudes and Resultant Policies Call for Water Conservation,
W79-05301 3F

IRRIGATION SCHEDULING
Solid State Control Systems for Irrigation,
W79-05289 3F

IRRIGATION SYSTEMS
Trickle Irrigation Tubing Hydraulics,
W79-05061 8B

Solar Cell Irrigation,
W79-05308 3F

Evaluation Criteria for Trickle Irrigation Emission Devices,
W79-05309 3F

Bacterial Clogging in Low Pressure Irrigation Systems,
W79-05312 3F

Control System for Irrigation Pumps,
W79-05373 3F

Water Drive System for a Center Pivot Irrigation Unit or the Like,
W79-05387 3F

Irrigation Apparatus,
W79-05389 3F

IRRIGATION WATER
The Economic Value of Irrigation Water in the Western United States: An Application of Ridge Regression,
W79-05399 6B

IRRIGATION WELLS
Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska,
W79-05161 4B

ISLANDS
Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

ISLE OF SYLT (WEST GERMANY)
Wave-Current Interaction Models for Rip Currents,
W79-05267 2L

JAPAN
Calcite as a Source of Excess Calcium in Rainwater,
W79-05262 2K

JUVENILE FISH
Self-Contained Upwelling System for Rearing Larval Fishes in the Laboratory,
W79-05182 5A

JUVENILE STAGES
Modified Neuston Net for Collecting Live Larval and Juvenile Fish,
W79-05211 5A

KENNEBEC RIVER
Kennebec River Corridor Plan -- A Management Plan for a Rejuvenated Resource,
W79-05402 6B

Kennebec River Corridor Project -- Appendix I: Demography,
W79-05403 6B

Kennebec River Corridor Project -- Appendix II: Water Resources,
W79-05404 6B

Kennebec River Corridor Project -- Appendix III: Flow Regulation,
W79-05405 6B

Kennebec River Corridor Project -- Appendix IV: Flooding,
W79-05406 6B

Kennebec River Corridor Project -- Appendix V: Management Plan,
W79-05407 6B

KENTUCKY
Copper, Nickel, and Zinc Released from Acid Coal Mine Spoil Materials of Eastern Kentucky,
W79-05044 5A

KERN RIVER WATERSHED
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

KINGS RIVER WATERSHED
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

KISSIMMEE RIVER BASIN
Drainage Density at Index of Watershed Development,
W79-05034 4A

KNOX COUNTY (TX)
The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume I.
W79-05014 2F

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

KOPPERS HYDRATE PROCESS
The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-05368 3A

LABORATORY APPARATUS
Multiple Bottle Holder for In Situ Measurement of Primary Productivity,
W79-05201 5A

LABORATORY EQUIPMENT
Hatching Table for Fisheries Research,
W79-05178 5A

Self-Contained Upwelling System for Rearing Larval Fishes in the Laboratory,
W79-05182 5A

Atlantic Salmon Embryos and Fry: Effects of Various Incubation and Rearing Methods on Hatchery Survival and Growth,
W79-05187 5C

Modified Neuston Net for Collecting Live Larval and Juvenile Fish,
W79-05211 5A

LABORATORY TESTS
Development and Evaluation of a Two-Step Membrane Filter Method for Fecal Coliform Recovery in Chlorinated Sewage Effluents,
W79-05012 5A

Characterization of Rill and Interrill Eroded Soil,
W79-05040 2J

Modifications of Temperature Avoidance Troughs for Testing Small Fishes,
W79-05185 5A

LAGOONS
The Phytoplankton Characteristics of the Barrier Island Lagoons of the Gulf of California,
W79-05337 5C

Population Dynamics and Production of a Planktonic Marine Copepod, Acartia Clausii, in a Small Temperate Lagoon on San Juan Island, Washington,
W79-05346 5C

LAKE BALATON (HUNGARY)
An Event-Based Stochastic Model of Phosphorus Loading into a Lake,
W79-05021 5B

LAKE JACKSON (FL)
Silt Barriers as Erosion Pollution Control in a Large Recreational Lake,
W79-05237 4D

LAKE OKEECHOBEE BASIN
Drainage Density at Index of Watershed Development,
W79-05034 4A

LAKE PAIJANNE (FINLAND)
Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

LAKES
Mathematical Modeling of Surface Water Impoundments, Volume: I, and II,
W79-05011 2H

An Event-Based Stochastic Model of Phosphorus Loading into a Lake,
W79-05021 5B

Characteristics of the Oswego River Plume and Its Influence on the Nearshore Environment,
W79-05118 2E

Characteristics of Pennsylvania Recreational Lakes,
W79-05168 2H

Silt Barriers as Erosion Pollution Control in a Large Recreational Lake,
W79-05237 4D

A Time-Dependent Model of a Coastal Boundary Layer with Friction,
W79-05263 2H

LAND APPLICATION
Effects of Sludge Applications on Soil Water Solution and Vegetation in a Northern Hardwood Stand,
W79-05002 5E

Land Application of Waste--Important Alternative,
W79-05032 5E

Land Application of Waste--State of the Art,
W79-05033 5E

Land Application of Waste--An Accident Waiting to Happen,
W79-05126 5B

Sludge to Land--Economic Considerations for Water Authorities,
W79-05320 6B

Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

LAND RECLAMATION
Flood-Plain Management in Dallas, Tex.: 1908-1978,
W79-05272 6F

LAND SUBSIDENCE
Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

LAND TREATMENT
Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

LAND USE
Drainage Density at Index of Watershed Development,
W79-05034 4A

Erosion Simulation for Land Use Management,
W79-05055 2J

Land Use Effects on Claypan Soil Hydrology,
W79-05063 4A

Trends in Streamflow Due to Upstream Land-Use Changes,
W79-05147 2E

Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

Summary of Watershed Conditions in the Vicinity of Redwood National Park, California,
W79-05170 4D

Storm-Water Data for Bear Creek Basin, Jackson County, Oregon, 1977-78,
W79-05171 5B

Flood Hazard Analyses: Little Catoctin Creek and Tributaries, Frederick County, Maryland.
W79-05246 2E

Integrating Water Resources and Land Use Planning,
W79-05408 6B

LANDFILLS
The Federal Ground-Water Protection Program--Tomorrow's Undoing,
W79-05129 5G

LANDSAT
Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

LARVAE
Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

LARVAL FISH
Modified Neuston Net for Collecting Live Larval and Juvenile Fish,
W79-05211 5A

LEACHING
Effects of Sludge Applications on Soil Water Solution and Vegetation in a Northern Hardwood Stand,
W79-05002 5E

LEAD
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

LEGAL ASPECTS
Institutional Arrangements for Effective Water Management in Colorado,
W79-05049 6E

Ground-Water Quality Standards--Irrelevant,
W79-05125 5B

State Ground-Water Protection Programs--A National Summary,
W79-05130 5G

State Ground-Water Protection Programs--Inadequate,
W79-05131 5G

State Ground-Water Protection Programs--Adequate,
W79-05132 5G

The German Federal Law on Wastewater Charges,
W79-05315 6E

LEGISLATION
The German Federal Law on Wastewater Charges,
W79-05315 6E

LIFE HISTORY STUDIES
The Short Day Response in Acrosymphyton Purpuriferum (J. Ag.) Sjost. (Rhodophyceae, Crytonemiales),
W79-05325 5C

LIGANDS
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

LIGHT
The Short Day Response in Acrosymphyton Purpuriferum (J. Ag.) Sjost. (Rhodophyceae, Crytonemiales),
W79-05325 5C

Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

LIGHT INTENSITY
Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

LIME
New Design Criteria for the Aerobic Digestion of Sewage Lime Sludge,
W79-05009 5D

LIMITING FACTORS
Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

LIMNOLOGY
Characteristics of Pennsylvania Recreational Lakes,
W79-05168 2H

LINDASPOLLENE (NORWAY)
Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

LITTLE CATOCTIN CREEK (MD)
Flood Hazard Analyses: Little Catoctin Creek and Tributaries, Frederick County, Maryland.
W79-05246 2E

LITTLE GOOSE DAM
Dip Basket for Collecting Juvenile Salmon and Trout in Gatewells at Hydroelectric Dams,
W79-05175 5A

LONG ISLAND
Artificial Recharge on Long Island, New York,
W79-05169 4B

LONG-TUBE VERTICAL DISTILLATION
Third Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-05082 3A

LONG-TUBE VERTICAL MULTIPLE EFFECT DISTILLATION
An Engineering Evaluation of the Long-Tube Vertical Falling-Film Distillation Process.
W79-05076 3A

LOUISIANA
Soil Erosion and Sediment Movement Under Sugarcane Culture on the Flat Lands of Southern Louisiana,
W79-05038 2J

LOW FLOW
7-Day Low Flows and Flow Duration of Alabama Streams Through 1973,
W79-05166 2E

LUBBOCK (TX)
Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

LUMBERING
Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forests Streams of Northern California,
W79-05005 5C

Summary of Watershed Conditions in the Vicinity of Redwood National Park, California,
W79-05170 4D

MACROPHYTES
The Chemical Composition of Aquatic Macrophytes. II. Amino Acid Composition of the Protein and Non-Protein in Fractions,
W79-05330 5C

Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

MAGNESIUM
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

MAINE
Kennebec River Corridor Plan -- A Management Plan for a Rejuvenated Resource,
W79-05402 6B

MANAGEMENT
Kennebec River Corridor Project -- Appendix V: Management Plan,
W79-05407 6B

Stormwater Management Model: Transfer of Technology,
W79-05412 5B

MANGANESE
The Riou-Mort a Tributary to the River Lot Polluted by Heavy Metals. I. Preliminary Observations on the Chemistry and Benthic Algae,
W79-05206 5B

MANUALS
Algae and Water Pollution,
W79-05322 5C

MANURE
Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

MAPPING
Image Enhancement of Side-Scan Sonar Mapping,
W79-05395 7B

MAPS
Annual Summary of Ground-Water Conditions in Arizona, Spring 1977 to Spring 1978,
W79-05151 4B

Flood and Related Debris Flow Hazards Map,
W79-05165 7C

MARINE ALGAE
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

MARYLAND
Flood Hazard Analyses: Little Catoctin Creek and Tributaries, Frederick County, Maryland.
W79-05246 2E

MASS TRANSFER
Investigation of Thermal Diffusion for Saline Water Conversion,
W79-05361 3A

MASSACHUSETTS
Transportation of Adult American Shad Past Dams on the Connecticut River, Massachusetts, 1973-76,
W79-05174 5C

Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

MATHEMATICAL MODELING
Mobile Bay Hydrography Under Flood Stage Conditions,
W79-05008 2L

MATHEMATICAL MODELS
Mathematical Modeling of Surface Water Impoundments, Volume: I, and II,
W79-05011 2H

Distributed Sources for Unconfined Groundwater Flow in a Half-Space,
W79-05025 2F

Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

Numerical Modeling of Liquid Geothermal Systems,
W79-05173 1A

Mathematical Modeling of Water Quality,
W79-05273 6A

A Mathematical Model for Predicting River Temperatures--Application to the Green River below Flaming Gorge Dam,
W79-05283 2H

Endogenous Bias in Technical Progress and Environmental Policy,
W79-05319 6B

Stormwater Management Model: Transfer of Technology,
W79-05412 5B

MATHEMATICAL STUDIES
The Use of Species Abundance Estimates in Marine Benthic Studies,
W79-05109 5A

MEASUREMENT
Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

MECHANICAL EQUIPMENT
Reconnaissance Assessment of Erosion and Sedimentation in the Canada De Los Alamos Basin, Los Angeles and Ventura Counties, California,
W79-05172 2J

MELTING
Melting of a Prairie Snowpack,
W79-05252 2C

Computer Simulation of Bubbler-Induced Melting of Ice Covers Using Experimental Heat Transfer Results,
W79-05279 2C

MEMBRANE PROCESSES
Investigation and Preparation of Polymer Films to Improve the Separation of Water and Salts in Saline Water Conversion.
W79-05083 3A

MEMBRANES
Development of DRY-RO Membranes from Sulfonated Cellulose Acetates and Quaternized Cellulose Acetate Carbamates,
W79-05045 3A

Investigation and Preparation of Polymer Films to Improve the Separation of Water and Salts in Saline Water Conversion.
W79-05083 3A

MERCURY
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

A Mercury Buffer for Toxicity Experiments with Green Algae,
W79-05210 5A

Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

MERCURY COMPOUNDS
A Mercury Buffer for Toxicity Experiments with Green Algae,
W79-05210 5A

MERCURY HERRINGS
Comparative Studies on Methods for Determining Total Mercury in Fish. Dithizone and Flameless Atomic Absorption Spectrophotometry Techniques,
W79-05183 5B

MERLUCCIUS
Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

METABOLISM
The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

METALS
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

Treatment of Effluents,
W79-05385 5D

METHODOLOGY
Hatching Table for Fisheries Research,
W79-05178 5A

Rapid Vacuum Method for Removal of Mucus from the Epidermis of Fishes,
W79-05180 5A

Self-Contained Upwelling System for Rearing Larval Fishes in the Laboratory,
W79-05182 5A

Modifications of Temperature Avoidance Troughs for Testing Small Fishes,
W79-05185 5A

Atlantic Salmon Embryos and Fry: Effects of Various Incubation and Rearing Methods on Hatchery Survival and Growth,
W79-05187 5C

Multiple Bottle Holder for In Situ Measurement of Primary Productivity,
W79-05201 5A

A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

METHYL PARATHION
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

METHYLMERCURY
Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

MICHIGAN
Ground-Water Quality Standards--A Neutral View,
W79-05123 5B

MICROBIAL DEGRADATION
Microbial Degradation of Dye Wastes in Aqueous Effluents,
W79-05048 5D

MIDA
A Mercury Buffer for Toxicity Experiments with Green Algae,
W79-05210 5A

MINIMUM FLOWS
Interacting Effects of Minimum Flow and Fluctuating Shorelines on Benthic Stream Insects,
W79-05233 2E

MINNESOTA
State Ground-Water Protection Programs--Adequate,
W79-05132 5G

MIREX
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

MISSOURI BASIN REGION
Summary Appraisals of the Nation's Ground-Water Resources--Missouri Basin Region,
W79-05152 7C

MISSOURI RIVER
Summary Appraisals of the Nation's Ground-Water Resources--Missouri Basin Region,
W79-05152 7C

Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

MIXING
Mixing Model for Large Streams,
W79-05133 5B

Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

MODEL STUDIES
Wear of Unsound Pebbles in River Headwaters,
W79-05016 2J

Simulated Streamflow Response to Possible Differences in Transpiration Among Species of Hardwood Trees,
W79-05018 2A

A Finite Element Method for the Diffusion-Convection Equation with Constant Coefficients,
W79-05019 5B

Behaviour of a Hydrodynamic Finite Element Model,
W79-05020 8B

An Event-Based Stochastic Model of Phosphorus Loading into a Lake,
W79-05021 5B

Computation of Shallow Water Waves with Hybrid Finite Elements,
W79-05022 2L

Estimating Design Flows for Urban Drainage,
W79-05024 2E

A Non-Linear Optimization Method for the Estimation of Aquifer Parameters,
W79-05026 2F

Radial Dispersion to an Abstraction Well,
W79-05027 2F

Finite-Difference Solutions for One-Dimensional Dispersion Using an Improved Mesh Design,
W79-05028 2F

Sizing of Reservoirs for Periodic-Stochastic Input and Periodic Output,
W79-05029 2H

Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

Systematic Diurnal Curve Analysis,
W79-05042 5B

Mixing Model for Large Streams,
W79-05133 5B

Mathematical Modeling of Sediment Deposition in Reservoirs,
W79-05142 2J

A Multivariate Model of Storm-Period Solute Behaviour,
W79-05144 5B

Expected Asymptotic Maximum Deficit for Periodic-Stochastic Reservoir Inflows in Case of Partial Flow Regulation,
W79-05145 2H

Trends in Streamflow Due to Upstream Land-Use Changes,
W79-05147 2E

Evaluation and Design of a Streamflow-Data Network in Washington,
W79-05159 7A

Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska,
W79-05161 4B

Predicting Nighttime Dissolved Oxygen Decline in Ponds Used for Tilapia Culture,
W79-05200 5B

Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

Modeling Two-Dimensional Circulating Flow,
W79-05255 8B

Obtaining Variations of Field Infiltration Capacity from Simulated Rainstorm Experiments (Determination Des Variations De La Capacite D'Absorption D'Un Sol En Place Sous Averses Simulees),
W79-05257 2G

Laterally Confined Flow from a Point Source at the Surface of an Inhomogeneous Soil Column,
W79-05261 2G

A Time-Dependent Model of a Coastal Boundary Layer with Friction,
W79-05263 2H

Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

Wave-Current Interaction Models for Rip Currents,
W79-05267 2L

Non-Point Water Quality Modeling in Wildland Management: A State-of-The-Art Assessment. (Volume I. Text).
W79-05269 5C

A Model Study of St. Marys River Ice Navigation,
W79-05278 2C

A Kinetic Model for Predicting the Composition of Chlorinated Water Discharged from Power Plant Cooling Systems,
W79-05491 5C

MOISTURE CONTENT
Errors in Gamma-Ray Measurements of Water Content and Bulk Density in Nonuniform Soils,
W79-05251 2G

The Applicability of Dual Gamma Scanning to Freezing Soils and the Problem of Stratification,
W79-05260 2C

MOISTURE STRESS
Effect of Soil Humidity on Nitrate Reductase Activity in Barley Shoot Leaves (In Russian),
W79-05314 2I

MOLLUSKS
Influence of Waste Residuals in Estuarine Waters on Development, Behavior and Survival of Soft-Shell Clam Larvae,
W79-05398 5C

MONITORING
The Amoco Cadiz Oil Spill-Lines of Study and Early Observations,
W79-05189 5A

Remote Sensing for Oil Pollution Control Along Coastal Waters of the United States,
W79-05393 7B

Remote Sensing of the Oceans - A Review,
W79-05394 7B

The Use of Landsat Imagery for Marine Pollution Studies,
W79-05396 7B

MONTANA
Water Resources Data for Montana, Water Year 1977,
W79-05162 7C

MORTALITY
Evaluation of pH Shock on Hatchery-Reared Rainbow Trout,
W79-05202 5C

MOSQUITO FISH
Toxicity of Phossy Water to Selected Freshwater Organisms,
W79-05095 5B

MOSQUITOFISH
Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

MOUNTAIN PARK DAM PROJECT (OK)
Review of Design, Construction, and Operation of Mountain Park Dam Project, Oklahoma,
W79-05240 8A

MS-222
Fingerling American Shad: Effect of Valium, MS-222, and Sodium Chloride on Handling Mortality,
W79-05179 5B

MT. ELBERT PROJECT (CO)
Review of Design, Construction, and Operation of Mt. Elbert Forebay Dam and Reservoir Project, Colorado,
W79-05241 8A

MUCUS REMOVAL
Rapid Vacuum Method for Removal of Mucus from the Epidermis of Fishes,
W79-05180 5A

MULCHING
Application of Straw in Agriculture in the Arid Steppe Zone of the Northern Kazakh SSR (In Russian),
W79-05343 2G

MULTIDISCIPLINARY TRANSFER MODEL
A Multidisciplinary Transfer Model for Water Management Knowledge Transfer in Developing Countries,
W79-05411 6A

MULTISTAGE FLASH DISTILLATION
The Oak Ridge National Laboratory Conceptual Design of a 250-mgd Desalination Plant.
W79-05072 3A

Cost Analysis of Six Water Desalting Processes,
W79-05074 3A

Parametric Cost Studies Pertaining to Dual-Purpose Power and Water Desalination Plants,
W79-05362 3A

MULTISTAGE FLASH EVAPORATION
A Study of Desalting Plants (15 to 150 MGD) and Nuclear Power Plants (200 to 1500 MWt) for Combined Water and Power Production.
W79-05075 3A

MUNICIPAL ENGINEERING
Flood-Plain Management in Dallas, Tex.: 1908-1978,
W79-05272 6F

MUNICIPAL WASTES
Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

The Growth Patterns of Some Enteric Bacteria in a Kraft Pulp Mill/Domestic Sewage Combined Treatment System,
W79-05420 5D

MYRIOPHYLLUM SPICATUM
Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

NAMBE FALLS DAM (NM)
Review of Design, Construction, and Operation of Nambe Falls Dam Project, New Mexico.
W79-05247 8A

NAVIGATION
A Model Study of St. Marys River Ice Navigation,
W79-05278 2C

NEBRASKA
Groundwater Levels in Nebraska, 1977,
W79-05150 2F

Nebraska Water Data Programs, 1978,
W79-05160 7C

Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska,
W79-05161 4B

NEOMYSIS
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

NETWORK DESIGN
Evaluation and Design of a Streamflow-Data Network in Washington,
W79-05159 7A

NEW BEDFORD HARBOR (MA)
Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

NEW JERSEY
Better Grasses for Roadsides,
W79-05238 6G

NEW MEXICO
Review of Design, Construction, and Operation of Nambe Falls Dam Project, New Mexico.
W79-05247 8A

NEW YORK
Heavy Metal Concentrations at the Apex of the New York Bight,
W79-05117 5A

Ground-Water Pollution--An Imminent Disaster,
W79-05121 5C

Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

NEW YORK BIGHT
MESA New York Light Project Annual Report for Fiscal Year 1977.
W79-05116 5B

Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

NEW ZEALAND
Wear of Unsound Pebbles in River Headwaters,
W79-05016 2J

NICKEL
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

NITRATE
Effect of Soil Humidity on Nitrate Reductase Activity in Barley Shoot Leaves (In Russian),
W79-05314 2I

NITRATES
Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

NITRIFICATION
Nitrification with Rotating Biological Contactor Systems,
W79-05047 5D

NITRIFYING BACTERIA
Nitrification with Rotating Biological Contactor Systems,
W79-05047 5D

NITROGEN
Modeling Nitrogen Movement in Agricultural Watersheds,
W79-05069 2G

Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

NITROGEN FIXATION
Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

NITROGEN FIXING BACTERIA
Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

NON-POINT SOURCE POLLUTION
Non-Point Water Quality Modeling in Wildland Management: A State-of-the-Art Assessment (Volume II - Appendixes).
W79-05270 5G

NON-STRUCTURAL ALTERNATIVES
Plan of Study: Case Studies of the Application of Cost Sharing Policy Options for Flood Plain Management in the Connecticut River Basin.
W79-05232 6F

NONPOINT POLLUTION
Nonpoint Source Pollution from Coastal Plain Soils in Delaware,
W79-05065 5B

Non-Point Water Quality Modeling in Wildland Management: A State-of-The-Art Assessment. (Volume I. Text).
W79-05269 5C

NONPROTEIN NITROGEN
The Chemical Composition of Aquatic Macrophytes. II. Amino Acid Composition of the Protein and Non-Protein in Fractions,
W79-05330 5C

NORA POND (NORTHWEST TERRITORIES
Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

NOVA SCOTIA
Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

NUCLEAR MOISTURE METERS
The Applicability of Dual Gamma Scanning to Freezing Soils and the Problem of Stratification,
W79-05260 2C

NUCLEAR POWERPLANTS
Parametric Cost Studies Pertaining to Dual-Purpose Power and Water Desalination Plants,
W79-05362 3A

NUCLEAR REACTORS
A Study of Desalting Plants (15 to 150 MGD) and Nuclear Power Plants (200 to 1500 MWt) for Combined Water and Power Production.
W79-05075 3A

Preliminary Design Study of an Optimum Nuclear Reactor-Saline Water Evaporator Process,
W79-05369 3A

NUMERICAL ANALYSIS
Numerical Modeling of Liquid Geothermal Systems,
W79-05173 1A

NUTRIENT REMOVAL
Nonpoint Source Pollution from Coastal Plain Soils in Delaware,
W79-05065 5B

NUTRIENTS
Movement of Pesticides and Nutrients with Water and Sediment as Affected by Tillage Practices: A Field Study,
W79-05050 5B

Effect of Transpiration Rate on the Uptake of Mineral Elements by Alfalfa Plants (In Bulgarian),
W79-05321 2I

Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

OFF-ROAD VEHICLES
Reconnaissance Assessment of Erosion and Sedimentation in the Canada De Los Alamos Basin, Los Angeles and Ventura Counties, California,
W79-05172 2J

OGALLALA FORMATION
Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska,
W79-05161 4B

OHIO
Ground-Water Pollution--An Imminent Disaster,
W79-05121 5C

OIL
Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

Editorial Introduction,
W79-05188 5A

The Amoco Cadiz Oil Spill-Lines of Study and Early Observations,
W79-05189 5A

The Ecological Impact on and Near Shores by the Amoco Cadiz Oil Spill,
W79-05190 5B

Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

Notes on the Condition in September 1978 of Some Intertidal Sands Polluted by Amoco Cadiz Oil,
W79-05193 5B

Preliminary Observations on Pollution of the Sea Bed and Disturbance of Sub-Littoral Communities in Northern Brittany by Oil from the Amoco Cadiz,
W79-05194 5B

The Amoco Cadiz Oil Spill. A Summary of Observations Made By U.S. Scientists 23 March-10 May, 1978,
W79-05195 5C

Petroleum Hydrocarbon Analyses Conducted Following the Wreck of the Supertanker Amoco Cadiz,
W79-05196 5A

OIL POLLUTION

A Bioassay Laboratory Boat with Comparisons of Central Vs. Boat Laboratory Bioassay Evaluations,
W79-05111 5A

The Ecological Impact on and Near Shores by the Amoco Cadiz Oil Spill,
W79-05190 5B

The Effects of Oil on Temperature Regulation in Sea Otters,
W79-05214 5C

Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

The Interaction of Oil with Sea Ice,
W79-05217 5C

Transport Mechanisms and Hydrocarbon Adsorption Properties of Suspended Matter in Lower Cook Inlet,
W79-05218 5C

Distribution and Dynamics of Heavy Metals in Alaskan Shelf Environments Subject to Oil Development,
W79-05219 5C

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05220 5C

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05221 5C

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Continental Shelf,
W79-05222 5C

Activity-Directed Fractionation of Petroleum Samples,
W79-05223 5C

The Transport and Behavior of Oil Spilled in and Under Sea Ice,
W79-05224 5C

Ballasted Floating Barrier Boom,
W79-05376 5G

Oil Separation Material,
W79-05378 5G

Polluting Oil Recovery Apparatus,
W79-05390 5G

Control of Oil Pollution by Remote Sensing Along the Shores of France,
W79-05392 7B

Remote Sensing for Oil Pollution Control Along Coastal Waters of the United States,
W79-05393 7B

OIL SPILLS

Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

Editorial Introduction,
W79-05188 5A

The Amoco Cadiz Oil Spill-Lines of Study and Early Observations,
W79-05189 5A

Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

Notes on the Condition in September 1978 of Some Intertidal Sands Polluted by Amoco Cadiz Oil,
W79-05193 5B

Preliminary Observations on Pollution of the Sea Bed and Disturbance of Sub-Littoral Communities in Northern Brittany by Oil from the Amoco Cadiz,
W79-05194 5B

The Amoco Cadiz Oil Spill. A Summary of Observations Made By U.S. Scientists 23 March-10 May, 1978,
W79-05195 5C

Petroleum Hydrocarbon Analyses Conducted Following the Wreck of the Supertanker Amoco Cadiz,
W79-05196 5A

Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development,
W79-05212 5C

Coastal Morphology, Oil Spill Vulnerability and Sedimentology of Kotzebue Sound and Kodiak Island,
W79-05213 5C

The Interaction of Oil with Sea Ice,
W79-05217 5C

The Transport and Behavior of Oil Spilled in and Under Sea Ice,
W79-05224 5C

Polluting Oil Recovery Apparatus,
W79-05390 5G

Control of Oil Pollution by Remote Sensing Along the Shores of France,
W79-05392 7B

OKLAHOMA

Review of Design, Construction, and Operation of Mountain Park Dam Project, Oklahoma,
W79-05240 8A

Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

ON-SITE DATA COLLECTIONS

A Bioassay Laboratory Boat with Comparisons of Central Vs. Boat Laboratory Bioassay Evaluations,
W79-05111 5A

ON-SITE-INVESTIGATION

The Ecological Impact on and Near Shores by the Amoco Cadiz Oil Spill,
W79-05190 5B

ON-SITE-INVESTIGATIONS

The Amoco Cadiz Oil Spill. A Summary of Observations Made By U.S. Scientists 23 March-10 May, 1978,
W79-05195 5C

Mitigating Adverse Environmental Effects of Highway Construction.
W79-05235 6G

OPEN CHANNEL FLOW

Scour and Fill in a Stream Channel, East Fork River, Western Wyoming,
W79-05149 2J

OPTIMIZATION

Analysis and Optimization of a Reverse Osmosis Water Purification System,
W79-05073 3A

Interactive Multiple Objective Optimization,
W79-05092 6A

A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

OPTIMUM DEVELOPMENT PLANS

Defining Upper Limits to Groundwater Development in the Arid West,
W79-05271 4B

OREGON

A Geographically Variable Water Quality Index Used in Oregon,
W79-05043 5B

Ground-Water Pollution--An Imminent Disaster,
W79-05121 5C

ORGANIC COMPOUNDS

Identification of Major Organic Constituents in Textile Waste Water Resulting from the Use of Sulfur Dyes,
W79-05230 5B

ORGANIC MATTER

The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

ORGANIC MERCURY

Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

ORGANIZATIONS

Interdisciplinary Team Approach to Mitigating Adverse Environmental Impacts of Highway Construction,
W79-05236 6G

OTTERS

The Effects of Oil on Temperature Regulation in Sea Otters,
W79-05214 5C

OUTER CONTINENTAL SHELF
Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development,
W79-05212 5C

Coastal Morphology, Oil Spill Vulnerability and Sedimentology of Kotzebue Sound and Kodiak Island,
W79-05213 5C

The Effects of Oil on Temperature Regulation in Sea Otters,
W79-05214 5C

Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

The Interaction of Oil with Sea Ice,
W79-05217 5C

Transport Mechanisms and Hydrocarbon Adsorption Properties of Suspended Matter in Lower Cook Inlet,
W79-05218 5C

Distribution and Dynamics of Heavy Metals in Alaskan Shelf Environments Subject to Oil Development,
W79-05219 5C

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05220 5C

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05221 5C

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Continental Shelf,
W79-05222 5C

Activity-Directed Fractionation of Petroleum Samples,
W79-05223 5C

The Transport and Behavior of Oil Spilled in and Under Sea Ice,
W79-05224 5C

Control of Oil Pollution by Remote Sensing Along the Shores of France,
W79-05392 7B

Remote Sensing for Oil Pollution Control Along Coastal Waters of the United States,
W79-05393 7B

The Use of Landsat Imagery for Marine Pollution Studies,
W79-05396 7B

OVERLAND FLOW
The Development of Overland Flow in a Tropical Rainforest Catchment,
W79-05030 2A

OXYGEN
Methods for Determining the Oxygen Consumption of a Fish Under Conditions of Aquatic Semi-Confinement (Methodes de Determination de la Consommation D'Oxygene D'un Poisson Dans Les Conditions Du Semi-Confinement Aquatique),
W79-05112 5A

Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

OXYGEN REQUIREMENTS
Methods for Determining the Oxygen Consumption of a Fish Under Conditions of Aquatic Semi-Confinement (Methodes de Determination de la Consommation D'Oxygene D'un Poisson Dans Les Conditions Du Semi-Confinement Aquatique),
W79-05112 5A

OZONE
Generation of Volatile Organic Compounds from Nonvolatile Precursors in Water by Treatment with Chlorine or Ozone,
W79-05482 5C

PALESTINCE LAKE (IN)
Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

PAPER MACHINES
Highly Effective Paper-Machine Shower Systems (Vysoko-effektinye Spryskovye Sistemy),
W79-05430 3E

PARAMETRIC HYDROLOGY
Development of a Hydrologic Model for a Canadian Watershed,
W79-05280 2A

PARTICLE SIZE
Flood and Related Debris Flow Hazards Map,
W79-05165 7C

Size Distribution of Eroded Material from Simulated Rainfall: Effect Over a Range of Texture,
W79-05259 2J

PATENTS
Process for Phosphate Conversion Coating with Treatment of Rinse Water by Reverse Osmosis and Ion Exchange,
W79-05372 5D

Control System for Irrigation Pumps,
W79-05373 3F

Spray Nozzle,
W79-05374 3F

Automatic Liquid Flow Control Device,
W79-05375 3F

Ballasted Floating Barrier Boom,
W79-05376 5G

Liquid Treatment Process,
W79-05377 5D

Oil Separation Material,
W79-05378 5G

Wind Correction Method and Apparatus for Irrigation Systems,
W79-05379 3F

Floating-Refuse-Collecting Boat,
W79-05380 5G

Method and Apparatus for Separating Solids from Liquids,
W79-05381 5D

Method of Clarifying and Removing Water from Water-Solids Suspensions,
W79-05383 5D

Ionization Chamber for Water Treatment System,
W79-05384 5F

Treatment of Effluents,
W79-05385 5D

Process for Purifying Waste Water Obtained by a Papermaking Process,
W79-05386 5D

Water Drive System for a Center Pivot Irrigation Unit or the Like,
W79-05387 3F

Flow Measurement,
W79-05388 4A

Irrigation Apparatus,
W79-05389 3F

Polluting Oil Recovery Apparatus,
W79-05390 5G

Process for Inhibiting Corrosion of Metals in Aqueous Systems,
W79-05391 5F

Bleach Plant Operation,
W79-05497 3E

PATH OF POLLUTANTS
Ground-Water Pollution--A Limited Problem,
W79-05122 5B

Mixing Model for Large Streams,
W79-05133 5B

Biscayne Aquifer, Southeast Florida,
W79-05155 5B

Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

PATHOGENIC BACTERIA
Vibrio Cholerae, Vibrio Parahaemolyticus, and other Vibrios: Occurrence and Distribution in Chesapeake Bay,
W79-05104 5C

PATHOGENS
Detection of Enteroviruses and Bacterial Pathogens Surviving Standard Sewage Treatment,
W79-05090 5B

PAVLORA
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

PEAK RUNOFF
Estimating Design Flows for Urban Drainage,
W79-05024 2E

PEBBLES
Wear of Unsound Pebbles in River Headwaters,
W79-05016 2J

PENNSYLVANIA
Relationship Between Alluvial Soils and Flooding in the Piedmont Lowland of Southeastern Pennsylvania,
W79-05017 2E

Characteristics of Pennsylvania Recreational Lakes,
W79-05168 2H

PERIPHYTON
Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

PERMEABILITY
Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

PERMETHRIN
Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

PERMSELECTIVE MEMBRANES
Test Manual (Tentative) for Permselective Membranes.
W79-05086 3A

PESTICIDE KINETICS
Movement of Pesticides and Nutrients with Water and Sediment as Affected by Tillage Practices: A Field Study,
W79-05050 5B

PESTICIDE RESIDUES
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

PESTICIDE TOXICITY
Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

Development of a Rapid Tissue Bioassay Technique for Screening Pollutant Effects on Fish,
W79-05229 5A

PETROLEUM HYDROCARBONS
Petroleum Hydrocarbon Analyses Conducted Following the Wreck of the Supertanker Amoco Cadiz,
W79-05196 5A

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

PHAEODACTYLUM
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

PHAEOPHYTA
Productivity Studies on Baltic Macroalgae,
W79-05347 5C

PHENOLS
Effect of Phenol Upon Activation and Fertilization Ability of Rainbow Trout Spermatozoa (Salmo Gairdneri Rich.) (In Polish),
W79-05176 5C

PHOSPHORUS
Effect of Phosphorus Supply on Algal Biomass in a Turbid Missouri Reservoir,
W79-05001 5C

An Event-Based Stochastic Model of Phosphorus Loading into a Lake,
W79-05021 5B

Toxicity of Phossy Water to Selected Freshwater Organisms,
W79-05095 5B

Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

PHOSSY WATER
Toxicity of Phossy Water to Selected Freshwater Organisms,
W79-05095 5B

PHOTOASSIMILATION
Patterns of Photoassimilatory Products in Pacific Rhodophyceae,
W79-05328 5C

PHOTOLYSIS
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

PHOTOPERIODISM
The Short Day Response in Acrosymphyton Purpuriferum (J. Ag.) Sjost. (Rhodophyceae, Crytonemiales),
W79-05325 5C

PHOTOSYNTHESIS
The Influence of Turbidity on Net Phytoplankton Photosynthesis in Some Irish Lakes,
W79-05098 5C

Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

Effect of Sulfur Dioxide on Algae,
W79-05352 5C

PHOTOSYNTHETIC PRODUCTS
Patterns of Photoassimilatory Products in Pacific Rhodophyceae,
W79-05328 5C

PHRAGMITES COMMUNIS
The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

PHYSICOCHEMICAL PROPERTIES
Thermodynamic Properties of Saline Water,
W79-05359 3A

PHYTOPLANKTON
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

The Influence of Turbidity on Net Phytoplankton Photosynthesis in Some Irish Lakes,
W79-05098 5C

An Annual Phytoplankton Study in Coastal Waters Off Eastern Long Island (Block Island Sound),
W79-05231 5C

The Phytoplankton Characteristics of the Barrier Island Lagoons of the Gulf of California,
W79-05337 5C

Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

PICEANCE BASIN
Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado, 1975-76,
W79-05164 2F

PIGMENTS
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

PILOT PLANTS
Operation and Maintenance of 37,000 GPD Thin-Film Distillation Pilot Plant.
W79-05079 3A

PIPELINES
Trickle Irrigation Tubing Hydraulics,
W79-05061 8B

PIRACETAM
Behavioral Toxicology and Teleost Fish,
W79-05100 5C

PLANNING
Interdisciplinary Team Approach to Mitigating Adverse Environmental Impacts of Highway Construction,
W79-05236 6G

Collective Decision Making in Water Resource Planning,
W79-05274 6A

An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

Integrating Water Resources and Land Use Planning,
W79-05408 6B

PLANT GROWTH
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

PLANT MORPHOLOGY
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

PLANT PHYSIOLOGY
Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

PLANT POPULATIONS
The Use of Species Abundance Estimates in Marine Benthic Studies,
W79-05109 5A

PLASTICS
Weathering Tests of Plastics and Design of Suspended Envelope Solar Stills,
W79-05371 3A

POIKILOTHERMS
Predicting Effects of Cold Shock: Modeling the Decline of a Thermal Plume,
W79-05094 5B

POINT-SOURCE DISCHARGE
Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

POLITICAL ASPECTS
Institutional Arrangements for Effective Water Management in Colorado,
W79-05049 6E

POLLUTANT IDENTIFICATION
Copper, Nickel, and Zinc Released from Acid Coal Mine Spoil Materials of Eastern Kentucky,
W79-05044 5A

Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

Control of Oil Pollution by Remote Sensing Along the Shores of France,
W79-05392 7B

POLLUTANTS
Radial Dispersion to an Abstraction Well,
W79-05027 2F

Heavy Metal Concentrations at the Apex of the New York Bight,
W79-05117 5A

A Multivariate Model of Storm-Period Solute Behaviour,
W79-05144 5B

Systems for Rapid Ranking of Environmental Pollutants. Selection of Subjects for Scientific and Technical Assessment Reports,
W79-05286 5A

POLLUTION ABATEMENT
Endogenous Bias in Technical Progress and Environmental Policy,
W79-05319 6B

Remote Sensing of the Oceans - A Review,
W79-05394 7B

POLLUTION TAXES (CHARGES)
The German Federal Law on Wastewater Charges,
W79-05315 6E

A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

POLYMERS
Investigation and Preparation of Polymer Films to Improve the Separation of Water and Salts in Saline Water Conversion.
W79-05083 3A

PONDING
Artificial Recharge on Long Island, New York,
W79-05169 4B

PONDS
Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

POPULATION DYNAMICS
Population Dynamics and Production of a Planktonic Marine Copepod, Acartia Clausii, in a Small Temperate Lagoon on San Juan Island, Washington,
W79-05346 5C

POROUS MEDIA
Finite-Difference Solutions for One-Dimensional Dispersion Using an Improved Mesh Design,
W79-05028 2F

PORTLAND AREA
Analysis of Urban Storm-Water-Quality from Seven Basins Near Portland, Oregon,
W79-05156 5B

POTASSIUM
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

POWERLANTS
Ecological Observation on the Adult Salmon: I. Diurnal Variation of Upstream Migration of the Adult Chum Salmon in the Chitose River (In Japanese),
W79-05348 6G

POWERPLANTS
Application of Phased Cooling to a Once-Through Cooling System,
W79-05227 5B

PRECIPITATION (ATMOSPHERIC)
Calcite as a Source of Excess Calcium in Rainwater,
W79-05262 2K

PREDATION
Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

PREFERENCE STRUCTURE
Evaluation of Proposed Storage Sites,
W79-05277 6B

PRIMARY PRODUCTION
Effect of Phosphorus Supply on Algal Biomass in a Turbid Missouri Reservoir,
W79-05001 5C

Kansas River Limnology: Seasonal Variations in Photosynthetic Production and Heavy Metal Accumulation by Aquatic Insects,
W79-05234 5C

PRIMARY PRODUCTIVITY
Multiple Bottle Holder for In Situ Measurement of Primary Productivity,
W79-05201 5A

The Phytoplankton Characteristics of the Barrier Island Lagoons of the Gulf of California,
W79-05337 5C

Productivity Studies on Baltic Macroalgae,
W79-05347 5C

Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

PROCHLORON
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

PROCHLOROPHYTA
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

PRODUCTION FUNCTIONS
Water Production Functions for Irrigated Agriculture,
W79-05275 3F

PRODUCTIVITY
Population Dynamics and Production of a Planktonic Marine Copepod, Acartia Clausii, in a Small Temperate Lagoon on San Juan Island, Washington,
W79-05346 5C

Community Production and Respiration by Ciliated Protozoa in the Benthos of a Small Eutrophic Loch,
W79-05354 5C

PROGRAMS
Nebraska Water Data Programs, 1978,
W79-05160 7C

PROJECTS
The United States Geological Survey in Alaska: Accomplishments During 1977.
W79-05167 7C

PROTEINS
The Chemical Composition of Aquatic Macrophytes. II. Amino Acid Composition of the Protein and Non-Protein in Fractions,
W79-05330 5C

PROTOZOA
The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

Community Production and Respiration by Ciliated Protozoa in the Benthos of a Small Eutrophic Loch,
W79-05354 5C

PTYGURA BEAUCHAMPI
Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

PUBLIC HEALTH
Vibrio Cholerae, Vibrio Parahaemolyticus, and other Vibrios: Occurrence and Distribution in Chesapeake Bay,
W79-05104 5C

The Epidemiologic Approach to the Evaluation of Organics in Drinking Water,
W79-05464 5C

A Case Control Study of Gastrointestinal and Urinary Tract Cancer Mortality and Drinking Water Chlorination,
W79-05465 5C

Mutagenicity and Water Chlorination: Prospect and Perspective,
W79-05466 5C

The Mutagenic Activity of Halogenated Compounds Found in Chlorinated Drinking Water,
W79-05467 5C

Mutagenicity of Complex Mixtures from Drinking Water,
W79-05468 5C

A Priori Predictive Methods of Assessing Health Effects of Chemicals in the Environment,
W79-05469 5C

Development of Resistant Poliovirus by Repetitive Sublethal Exposure to Chlorine,
W79-05470 5C

Epidemic Problems and Chlorination of Drinking Water and Sewage in the Federal Republic of Germany,
W79-05471 5C

PUEBLO DAM PROJECT (CO)
Review of Design, Construction, and Operation of Pueblo Dam Project, Colorado,
W79-05243 8A

PULP AND PAPER INDUSTRY
Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

White Water Recycled at C.I.P. (Canadian International Paper Co.), Dalhousie, N.B.,
W79-05421 3E

Effect of Process Water Recycle on Pollution Control and Energy Conservation,
W79-05422 3E

The Impact of Oxygen Delignification System on Screen Room and Bleach Plant Effluents,
W79-05423 3E

Survey on Sesayap River as Possible Water Resource for a Pulp and Paper Mill (In Indonesia) (Survai sungai Sesayap dan kemungkinannya sebagai sumber air untrk pabrik pulp dan kertas),
W79-05427 6D

Highly Effective Paper-Machine Shower Systems (Vysoko-effektinye Spryskovye Sistemy),
W79-05430 3E

Absolute Solution to Industrial Waste Water Problem--Outfall Prevention (Die absolute Loesung des Industrieabwasser--problems -- Unterbindung des Abflusses),
W79-05433 3E

Bleach Plant Operation,
W79-05497 3E

PULP WASTES
Influence of Dilution Water on the Toxicity of Kraft Pulp and Paper Mill Effluent, Including Mechanisms of Effect,
W79-05105 5A

Process for Purifying Waste Water Obtained by a Papermaking Process,
W79-05386 5D

Primary Effluent Treatment at (Consolidated-Bathurst Ltd.) Pontiac (Division, Quebec),
W79-05416 5D

Problems Associated with an Aerated Lagoon,
W79-05417 5D

Primary Effluent Treatment at Domtar (Fine Papers Ltd.) Cornwall Mill,
W79-05418 5D

Effluent Treatment at Prince George Pulp and Paper Ltd.,
W79-05419 5D

The Growth Patterns of Some Enteric Bacteria in a Kraft Pulp Mill/Domestic Sewage Combined Treatment System,
W79-05420 5D

Development of a Practical Method to Reduce the Toxicity of Kraft Mill Effluents by Retaining some of the Toxic Materials with the Pulp,
W79-05424 5D

Use of the Activated Sludge Process in the Treatment of Thermomechanical Pulping Effluents,
W79-05425 5D

Toxicity of Treated and Untreated P. (Pinus) Radiata TMP (Thermomechanical Pulping) Effluents on a Number of Organisms,
W79-05426 5C

Refiner Pulp Mill Effluent. Part 2. Composition of Dissolved Solids Fraction,
W79-05496 5B

PUMPED STORAGE
Evaluation of Proposed Storage Sites,
W79-05277 6B

PUMPING
Annual Summary of Ground-Water Conditions in Arizona, Spring 1977 to Spring 1978,
W79-05151 4B

Biscayne Aquifer, Southeast Florida,
W79-05155 5B

PUMPS
A Solar-Powered Pump for Irrigation,
W79-05287 3F

Irrigation Efficiency in Scheduling,
W79-05304 3F

PUROMYCIN
Behavioral Toxicology and Teleost Fish,
W79-05100 5C

PUTTY-CLAY APPROACH
A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

RADAR
Radar Anisotropy of Sea Ice Due to Preferred Azimuthal Orientation of the Horizontal C Axes of Ice Crystals,
W79-05138 2C

RADIOIMMUNOASSAY
On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

RADIOISOTOPES
Utilization of Isotopes for Saline Water Conversion.
W79-05084 3A

RADIOSENSITIVITY
Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

RADLEY POND (UNITED KINGDOM)
Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

RAINBOW TROUT
Histopathological Changes in the Fish After Intoxication with Non-Ionogenic Tensides on the Basis of Ethoxyl Aducts of Isononylphenols (Histopatologicke Zmeny u Ryb Po Intoxikaci Neionogennimi Tenzidy na Bazi Ethoxylovych Aduktu Isononylfenolu),
W79-05099 5C

Effect of Phenol Upon Activation and Fertilization Ability of Rainbow Trout Spermatozoa (Salmo Gairdneri Rich.) (In Polish),
W79-05176 5C

RAINFALL
Some Aspects of Florida Convective Rainfall,
W79-05139 2B

Calcite as a Source of Excess Calcium in Rainwater,
W79-05262 2K

Urban Rainfall-Runoff-Quality Data Base,
W79-05282 2A

RANGES
Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

RANKING
Evaluation of Proposed Storage Sites,
W79-05277 6B

Systems for Rapid Ranking of Environmental Pollutants. Selection of Subjects for Scientific and Technical Assessment Reports,
W79-05286 5A

RECLAIMED WATER
Artificial Recharge on Long Island, New York,
W79-05169 4B

RECREATION DEMAND
An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

RECYCLING
White Water Recycled at C.I.P. (Canadian International Paper Co.), Dalhousie, N.B.,
W79-05421 3E

Effect of Process Water Recycle on Pollution Control and Energy Conservation,
W79-05422 3E

REDUCTASE
Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

REDUCTION (CHEMICAL)
Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

REDWOOD CREEK
Summary of Watershed Conditions in the Vicinity of Redwood National Park, California,
W79-05170 4D

REDWOOD NATIONAL PARK
Summary of Watershed Conditions in the Vicinity of Redwood National Park, California,
W79-05170 4D

REGENERATION
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

REGIONAL ANALYSIS
Summary Appraisals of the Nation's Ground-Water Resources--Missouri Basin Region,
W79-05152 7C

Summary Appraisals of the Nation's Ground-Water Resources--South Atlantic-Gulf Region,
W79-05154 2F

Evaluation and Design of a Streamflow-Data Network in Washington,
W79-05159 7A

REGIONAL PLANNING
Distributing Regional Services Costs,
W79-05276 6C

REGULATED FLOW
Expected Asymptotic Maximum Deficit for Periodic-Stochastic Reservoir Inflows in Case of Partial Flow Regulation,
W79-05145 2H

REGULATION
The German Federal Law on Wastewater Charges,
W79-05315 6E

An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

REMOTE SENSING
The World Remote Sensing Index, A Comprehensive Geographic Index Bibliography to Remote Sensing Site Investigations of Natural and Agricultural Resources Throughout the World,
W79-05119 7B

Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

Acoustic Monitoring of Industrial Chemical Waste Release at Deep Water Dump Site 106,
W79-05264 5B

Control of Oil Pollution by Remote Sensing Along the Shores of France,
W79-05392 7B

Remote Sensing for Oil Pollution Control Along Coastal Waters of the United States,
W79-05393 7B

Remote Sensing of the Oceans - A Review,
W79-05394 7B

Image Enhancement of Side-Scan Sonar Mapping,
W79-05395 7B

The Use of Landsat Imagery for Marine Pollution Studies,
W79-05396 7B

REPRODUCTION
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

RESEARCH PRIORITIES
Analysis of Researchable Water Problems in the South Atlantic-Gulf Region,
W79-05401 9D

RESERVOIR CONSTRUCTION
Changes in the Species Composition of Fish in the River Lot,
W79-05184 5B

RESERVOIRS
Mathematical Modeling of Surface Water Impoundments, Volume: I, and II,
W79-05011 2H

Sizing of Reservoirs for Periodic-Stochastic Input and Periodic Output,
W79-05029 2H

Mathematical Modeling of Sediment Deposition in Reservoirs,
W79-05142 2J

Expected Asymptotic Maximum Deficit for Periodic-Stochastic Reservoir Inflows in Case of Partial Flow Regulation,
W79-05145 2H

Changes in the Species Composition of Fish in the River Lot,
W79-05184 5B

RESOURCES DEVELOPMENT
The Use of Landsat Imagery for Marine Pollution Studies,
W79-05396 7B

RESPIRATION
Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

Community Production and Respiration by Ciliated Protozoa in the Benthos of a Small Eutrophic Loch,
W79-05354 5C

RETENTION
Variability of Soil Water Retention Curves and Predicted Hydraulic Conductivities on a Small Plot,
W79-05136 2G

REVERSE OSMOSIS
Development of DRY-RO Membranes from Sulfonated Cellulose Acetates and Quaternized Cellulose Acetate Carbamates,
W79-05045 3A

Acid Mine Water Reverse Osmosis Test at Kittanning, Pennsylvania,
W79-05071 3A

Analysis and Optimization of a Reverse Osmosis Water Purification System,
W79-05073 3A

RHODOCHORTON PURPUREUM
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

RHODOPHYTA
The Short Day Response in Acrosymphyton Purpuriferum (J. Ag.) Sjost. (Rhodophyceae, Crytonemiales),
W79-05325 5C

Patterns of Photoassimilatory Products in Pacific Rhodophyceae,
W79-05328 5C

Productivity Studies on Baltic Macroalgae,
W79-05347 5C

RIP CURRENTS
Wave-Current Interaction Models for Rip Currents,
W79-05267 2L

RIRIE DAM (ID)
Review of Design, Construction, and Operation of Ririe Dam Project, Idaho,
W79-05244 8A

RIVER BASIN COMMISSIONS
Kennebec River Corridor Project -- Appendix I: Demography,
W79-05403 6B

Kennebec River Corridor Project -- Appendix V: Management Plan,
W79-05407 6B

RIVER BASIN DEVELOPMENT
Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

Kennebec River Corridor Plan -- A Management Plan for a Rejuvenated Resource,
W79-05402 6B

Kennebec River Corridor Project -- Appendix I: Demography,
W79-05403 6B

Kennebec River Corridor Project -- Appendix II: Water Resources,
W79-05404 6B

Kennebec River Corridor Project -- Appendix III: Flow Regulation,
W79-05405 6B

Kennebec River Corridor Project -- Appendix IV: Flooding,
W79-05406 6B

Kennebec River Corridor Project -- Appendix V: Management Plan,
W79-05407 6B

RIVER FLOW
Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

Kennebec River Corridor Project -- Appendix III: Flow Regulation,
W79-05405 6B

RIVER LOT
Changes in the Species Composition of Fish in the River Lot,
W79-05184 5B

RIVER TEES (ENGLAND)
Flow Resistance of Large-Scale Roughness,
W79-05141 2E

RIVERS
Systematic Diurnal Curve Analysis,
W79-05042 5B

A Geographically Variable Water Quality Index Used in Oregon,
W79-05043 5B

Characteristics of the Oswego River Plume and Its Influence on the Nearshore Environment,
W79-05118 2E

Mixing Model for Large Streams,
W79-05133 5B

Fluvial Processes and Facies Sequences in the Sandy Braided South Saskatchewan River, Canada,
W79-05135 2J

A Mathematical Model for Predicting River Temperatures--Application to the Green River below Flaming Gorge Dam,
W79-05283 2H

ROCKS
Wear of Unsound Pebbles in River Headwaters,
W79-05016 2J

RORIPPA NASTURTIUM-AQUATICUM
The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

ROTIFERS
Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

ROUGHNESS (HYDRAULIC)
Flow Resistance of Large-Scale Roughness,
W79-05141 2E

ROW SPACING
Influence of Row Spacing of Grain Sorghum on Ground Cover, Runoff, and Erosion,
W79-05258 3F

RUNOFF
Washoff of Herbicides Applied to Corn Residue,
W79-05036 5B

Obtaining Variations of Field Infiltration Capacity from Simulated Rainstorm Experiments (Determination Des Variations De La Capacite D'Absorption D'Un Sol En Place Sous Averses Simulees),
W79-05257 2G

Influence of Row Spacing of Grain Sorghum on Ground Cover, Runoff, and Erosion,
W79-05258 3F

Urban Rainfall-Runoff-Quality Data Base,
W79-05282 2A

RUNOFF COEFFICIENT
Runoff Curve Numbers with Varying Site Moisture,
W79-05023 2D

RUNOFF CURVE NUMBERS
Runoff Curve Numbers with Varying Site Moisture,
W79-05023 2D

SALINITY
Fingerling American Shad: Effect of Valium, MS-222, and Sodium Chloride on Handling Mortality,
W79-05179 5B

Palaemonid Shrimp, Macrobrachium Amazonicum: Effects of Salinity and Temperature on Survival,
W79-05181 5B

Self-Contained Upwelling System for Rearing Larval Fishes in the Laboratory,
W79-05182 5A

Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

SALMON
Ecological Observation on the Adult Salmon: I. Diurnal Variation of Upstream Migration of the Adult Chum Salmon in the Chitose River (In Japanese),
W79-05348 6G

SALT MARSHES
Diatom Community Structure: Taxonomic and Statistical Analyses of a Mississippi Salt Marsh,
W79-05007 5C

Algae of Saltmarshes on the South and Southwest Coasts of England,
W79-05335 5C

SAMPLING
Modified Neuston Net for Collecting Live Larval and Juvenile Fish,
W79-05211 5A

SAN JUAN-CHAMA PROJECT
Review of Design, Construction, and Operation of Nambe Falls Dam Project, New Mexico.
W79-05247 8A

SANDS
Notes on the Condition in September 1978 of Some Intertidal Sands Polluted by Amoco Cadiz Oil,
W79-05193 5B

SANTA ANA RIVER BASIN (CA)
A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

SATELLITES (ARTIFICIAL)
Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

SCALING
Ionization Chamber for Water Treatment System,
W79-05384 5F

SCALLOPS
Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

SCENEDESMUS
A Mercury Buffer for Toxicity Experiments with Green Algae,
W79-05210 5A

SCHEDULING
Scheduling of Water and Nitrogen for Corn in the Humid Midwest,
W79-05295 3F

SCOTOPHOBIN
Behavioral Toxicology and Teleost Fish,
W79-05100 5C

SCOUR
Scour and Fill in a Stream Channel, East Fork River, Western Wyoming,
W79-05149 2J

SCREENING
Evaluation of Proposed Storage Sites,
W79-05277 6B

SEA ICE
Radar Anisotropy of Sea Ice Due to Preferred Azimuthal Orientation of the Horizontal C Axes of Ice Crystals,
W79-05138 2C

The Interaction of Oil with Sea Ice,
W79-05217 5C

The Transport and Behavior of Oil Spilled in and Under Sea Ice,
W79-05224 5C

SEA WATER
Research and Development of Processes for Desalting Water by Freezing,
W79-05085 3A

Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

SEASONAL
Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

SEBASTES
Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

SEDIMENT DISTRIBUTION
Scour and Fill in a Stream Channel, East Fork River, Western Wyoming,
W79-05149 2J

SEDIMENT LOAD
Reducing Stream Sediment Loads by Irrigation Diversions,
W79-05057 2J

Excavated Sediment Traps – What Ralph Waldo Emerson was Really Talking About,
W79-05058 2J

SEDIMENT TRANSPORT
Sediment Characteristics and Transport from Northwest Rangeland Watersheds,
W79-05035 2J

Scour and Fill in a Stream Channel, East Fork River, Western Wyoming,
W79-05149 2J

Flood and Related Debris Flow Hazards Map,
W79-05165 7C

Summary of Watershed Conditions in the Vicinity of Redwood National Park, California,
W79-05170 4D

Transport Mechanisms and Hydrocarbon Adsorption Properties of Suspended Matter in Lower Cook Inlet,
W79-05218 5C

SEDIMENT YIELD
Sedroute Procedure for Estimating Erosion and Sediment Impacts,
W79-05066 2J

Reconnaissance Assessment of Erosion and Sedimentation in the Canada De Los Alamos Basin, Los Angeles and Ventura Counties, California,
W79-05172 2J

SEDIMENTOLOGY
Coastal Morphology, Oil Spill Vulnerability and Sedimentology of Kotzebue Sound and Kodiak Island,
W79-05213 5C

SEDIMENTS
Sediment Characteristics and Transport from Northwest Rangeland Watersheds,
W79-05035 2J

Sedimentation Modeling of Impoundment Terraces,
W79-05039 2J

Characterization of Rill and Interrill Eroded Soil,
W79-05040 2J

The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

Characteristics of the Oswego River Plume and Its Influence on the Nearshore Environment,
W79-05118 2E

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Continental Shelf,
W79-05222 5C

Size Distribution of Eroded Material from Simulated Rainfall: Effect Over a Range of Texture,
W79-05259 2J

Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

SELECTIVE LEVEL RELEASES

A Mathematical Model for Predicting River Temperatures--Application to the Green River below Flaming Gorge Dam,
W79-05283 2H

SELENIUM

Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

SENDAI (JAPAN)

Calcite as a Source of Excess Calcium in Rainwater,
W79-05262 2K

SENSITIVITY ANALYSIS

Evaluation of Proposed Storage Sites,
W79-05277 6B

SEPARATION TECHNIQUES

Treatment of Effluents,
W79-05385 5D

SERVICES

Distributing Regional Services Costs,
W79-05276 6C

SEWAGE DISPOSAL

Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

SEWAGE EFFLUENT

Land Application of Waste--Important Alternative,
W79-05032 5E

SEWAGE EFFLUENTS

Development and Evaluation of a Two-Step Membrane Filter Method for Fecal Coliform Recovery in Chlorinated Sewage Effluents,
W79-05012 5A

Land Application of Waste--State of the Art,
W79-05033 5E

Land Application of Waste--An Accident Waiting to Happen,
W79-05126 5B

SEWAGE SLUDGE

Surface Runoff from Sludge-Amended Soils,
W79-05041 5B

Sludge to Land--Economic Considerations for Water Authorities,
W79-05320 6B

SEWAGE TREATMENT

Liquid Treatment Process,
W79-05377 5D

Method and Apparatus for Separating Solids from Liquids,
W79-05381 5D

SEYMOUR AQUIFER

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume I.
W79-05014 2F

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

SHAD

Transportation of Adult American Shad Past Dams on the Connecticut River, Massachusetts, 1973-76,
W79-05174 5C

SHALLOW WATER

Computation of Shallow Water Waves with Hybrid Finite Elements,
W79-05022 2L

SHERWOOD ABSORPTION-DISTILLATION PROCESS

Absorption-Multistage Flash Distillation Process,
W79-05366 3A

SHORES

Wave-Current Interaction Models for Rip Currents,
W79-05267 2L

SHOWERS

Highly Effective Paper-Machine Shower Systems (Vysoko-effektinye Spryskovye Sistemy),
W79-05430 3E

SHRIMP

Palaemonid Shrimp, Macrobrachium Amazonicum: Effects of Salinity and Temperature on Survival,
W79-05181 5B

SIERRA NEVADA MOUNTAINS

Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

SILVER

Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

SIMULATED RAINFALL

Soil Erosion and Sediment Movement Under Sugarcane Culture on the Flat Lands of Southern Louisiana,
W79-05038 2J

SIMULATED STREAMFLOW

Simulated Streamflow Response to Possible Differences in Transpiration Among Species of Hardwood Trees,
W79-05018 2A

SIMULATION ANALYSIS

Continuous Simulation for Water Quality Planning,
W79-05010 6B

Predicting Nighttime Dissolved Oxygen Decline in Ponds Used for Tilapia Culture,
W79-05200 5B

Non-Point Water Quality Modeling in Wildland Management: A State-of-The-Art Assessment. (Volume I. Text).
W79-05269 5C

Computer Simulation of Bubbler-Induced Melting of Ice Covers Using Experimental Heat Transfer Results,
W79-05279 2C

Development of a Hydrologic Model for a Canadian Watershed,
W79-05280 2A

Feasibility Study on Executive Program Development for Basin Ecosystem Modeling,
W79-05285 5G

SITES

Evaluation of Proposed Storage Sites,
W79-05277 6B

SKELETONEMA COSTATUM

Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

SLUDGE

Effects of Sludge Applications on Soil Water Solution and Vegetation in a Northern Hardwood Stand,
W79-05002 5E

SLUDGE DISPOSAL

Surface Runoff from Sludge-Amended Soils,
W79-05041 5B

Sludge to Land--Economic Considerations for Water Authorities,
W79-05320 6B

SLUDGE TREATMENT

Sludge to Land--Economic Considerations for Water Authorities,
W79-05320 6B

SMELTERS

The Riou-Mort a Tributary to the River Lot Polluted by Heavy Metals. I. Preliminary Observations on the Chemistry and Benthic Algae,
W79-05206 5B

SNAKE RIVER

Dip Basket for Collecting Juvenile Salmon and Trout in Gatewells at Hydroelectric Dams,
W79-05175 5A

SNOW

Record Winter Storms in Illinois, 1977-1978,
W79-05013 2B

SNOWFALL

Calcite as a Source of Excess Calcium in Rainwater,
W79-05262 2K

SNOWMELT
Digital Simulation of Snowmelt Runoff,
W79-05091 2E

Melting of a Prairie Snowpack,
W79-05252 2C

SNOWPACKS
Melting of a Prairie Snowpack,
W79-05252 2C

SOCIAL ASPECTS
Societal Attitudes and Resultant Policies Call for Water Conservation,
W79-05301 3F

SOCKEYE SALMON
Survival of Salmon Smolts in Sea Water After Exposure to Air-Supersaturated Water,
W79-05191 5B

Effects of Continuous Zinc Exposure on Sockeye Salmon During Adult-to-Smolt Freshwater Residency,
W79-05203 5C

SODIUM
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

SODIUM CHLORIDE
Fingerling American Shad: Effect of Valium, MS-222, and Sodium Chloride on Handling Mortality,
W79-05179 5B

SOIL ALGAE
Diatom Community Structure: Taxonomic and Statistical Analyses of a Mississippi Salt Marsh,
W79-05007 5C

SOIL CHEMICAL PROPERTIES
Copper, Nickel, and Zinc Released from Acid Coal Mine Spoil Materials of Eastern Kentucky,
W79-05044 5A

SOIL EROSION
Soil Erosion and Sediment Movement Under Sugarcane Culture on the Flat Lands of Southern Louisiana,
W79-05038 2J

Sedimentation Modeling of Impoundment Terraces,
W79-05039 2J

Characterization of Rill and Interrill Eroded Soil,
W79-05040 2J

Erosion Simulation for Land Use Management,
W79-05055 2J

Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

Size Distribution of Eroded Material from Simulated Rainfall: Effect Over a Range of Texture,
W79-05259 2J

SOIL MOISTURE
Runoff Curve Numbers with Varying Site Moisture,
W79-05023 2D

SOIL PHYSICAL PROPERTIES
Errors in Gamma-Ray Measurements of Water Content and Bulk Density in Nonuniform Soils,
W79-05251 2G

SOIL PROFILES
Drainage in a Natural Layered Profile by Finite Element Analysis,
W79-05051 2G

SOIL WATER
Variability of Soil Water Retention Curves and Predicted Hydraulic Conductivities on a Small Plot,
W79-05136 2G

Obtaining Variations of Field Infiltration Capacity from Simulated Rainstorm Experiments (Determination Des Variations De La Capacite D'Absorption D'Un Sol En Place Sous Averses Simulees),
W79-05257 2G

SOIL WATER MOVEMENT
A Simple Finite Element Method of Infiltration,
W79-05064 2G

Predicting Dispersion Coefficients in Soils,
W79-05067 2G

SOILS
Relationship Between Alluvial Soils and Flooding in the Piedmont Lowland of Southeastern Pennsylvania,
W79-05017 2E

Soil Erosion and Sediment Movement Under Sugarcane Culture on the Flat Lands of Southern Louisiana,
W79-05038 2J

Laterally Confined Flow from a Point Source at the Surface of an Inhomogeneous Soil Column,
W79-05261 2G

SOLA
Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

SOLAR DISTILLATION
Solar Distillation of Sea Water in the Virgin Islands,
W79-05087 3A

Demineralization of Saline Water with Solar Energy,
W79-05088 3A

Weathering Tests of Plastics and Design of Suspended Envelope Solar Stills,
W79-05371 3A

SOLAR ENERGY
Solar Cell Irrigation,
W79-05308 3F

SOLAR STILLS
Solar Distillation of Sea Water in the Virgin Islands,
W79-05087 3A

Weathering Tests of Plastics and Design of Suspended Envelope Solar Stills,
W79-05371 3A

SOLDIER CREEK DAM (UT)
Review of Design, Construction, and Operation of Soldier Creek Dam Project, Utah.
W79-05239 8A

SOLUBILITY
Further Properties of Hydrates and Hydrating Agents.
W79-05089 3A

SOLUBILITY APPARATUS
Further Properties of Hydrates and Hydrating Agents.
W79-05089 3A

SOLUTES
A Multivariate Model of Storm-Period Solute Behaviour,
W79-05144 5B

SOLVENT EXTRACTION PROCESS
Development of the Solvent Demineralization of Saline Water,
W79-05370 3A

SOUTH ATLANTIC-GULF REGION
Summary Appraisals of the Nation's Ground-Water Resources--South Atlantic-Gulf Region,
W79-05154 2F

SOUTH FLORIDA
Drainage Density at Index of Watershed Development,
W79-05034 4A

SOUTH LAKE TAHOE QUADRANGLE
Flood and Related Debris Flow Hazards Map,
W79-05165 7C

SOUTH SASKATCHEWAN RIVER (CANADA)
Fluvial Processes and Facies Sequences in the Sandy Braided South Saskatchewan River, Canada,
W79-05135 2J

SOYBEANS
Reaction of Soybeans to Overflooding of Soil, (In Russian),
W79-05284 2I

SPECIES COMPOSITION
An Annual Phytoplankton Study in Coastal Waters Off Eastern Long Island (Block Island Sound),
W79-05231 5C

Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

SPECIES DIVERSITY
The Use of Species Abundance Estimates in Marine Benthic Studies,
W79-05109 5A

SPECIFIC ACTIVITY
Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

SPECTROPHOTOMETRY
Comparative Studies on Methods for Determining Total Mercury in Fish. Dithizone and Flameless Atomic Absorption Spectrophotometry Techniques,
W79-05183 5B

SPERMATOZOA
Effect of Phenol Upon Activation and Fertilization Ability of Rainbow Trout Spermatozoa (Salmo Gairdneri Rich.) (In Polish),
W79-05176 5C

SPRINKLER IRRIGATION
Electrical Load and Water Management,
W79-05290 3F

Center Pivots on Soils Marginally Suited for Irrigation in Manitoba, Canada,
W79-05291 3F

Economics of Irrigation,
W79-05292 3F

Application of End Guns on Center Pivots,
W79-05293 3F

Limits of Low Pressure Sprinklers and Spray Nozzles on Center Pivot Applications,
W79-05294 3F

The Role of Sprinkler Irrigation in Producing Specialty Crops,
W79-05296 3F

Factors Influencing System Selection in Humid Regions,
W79-05297 3F

The Use of Overtree Irrigation for Crop Cooling and Frost and Freeze Protection on Apples,
W79-05298 3F

Optimizing Traveling Sprinkler System Performance,
W79-05299 3F

Introduction to Irrigation Efficiency and Scheduling,
W79-05300 3F

Comparative Efficiency of Irrigation Systems,
W79-05303 3F

IA Sprinkler Test Standards,
W79-05313 3F

Spray Nozzle,
W79-05374 3F

Wind Correction Method and Apparatus for Irrigation Systems,
W79-05379 3F

SQUAWFISH
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

ST. GEORGE BAY (NOVA SCOTIA)
Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

STABILITY
Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

STANDARDS
A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

STANDING CROPS
Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

STATE AGENCIES
Nebraska Water Data Programs, 1978,
W79-05160 7C

STATE GOVERNMENTS
State Ground-Water Protection Programs--A National Summary,
W79-05130 5G

State Ground-Water Protection Programs--Inadequate,
W79-05131 5G

State Ground-Water Protection Programs--Adequate,
W79-05132 5G

STATISTICAL METHODS
A Simple Version of Gumbel's Method for Flood Estimation,
W79-05256 2E

STEADY-STATE LEVEL
Defining Upper Limits to Groundwater Development in the Arid West,
W79-05271 4B

STEAM TURBINES
A Study of Desalting Plants (15 to 150 MGD) and Nuclear Power Plants (200 to 1500 MWt) for Combined Water and Power Production.
W79-05075 3A

STEPWISE MULTIPLE REGRESSION
A Water Demand and Wastewater Disposal Model for Optimum Transfer of Water Resources Technology in Developing Countries,
W79-05413 6D

STEROIDS
On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

STORAGE CAPACITY
Sizing of Reservoirs for Periodic-Stochastic Input and Periodic Output,
W79-05029 2H

Expected Asymptotic Maximum Deficit for Periodic-Stochastic Reservoir Inflows in Case of Partial Flow Regulation,
W79-05145 2H

STORAGE COEFFICIENT
A Non-Linear Optimization Method for the Estimation of Aquifer Parameters,
W79-05026 2F

STORM RUNOFF
A Multivariate Model of Storm-Period Solute Behaviour,
W79-05144 5B

Analysis of Urban Storm-Water-Quality from Seven Basins Near Portland, Oregon,
W79-05156 5B

Evaluation of the Effects of Urbanization on Stormwater Runoff and Quality,
W79-05400 4C

STORM SEWERS
Urban Rainfall-Runoff-Quality Data Base,
W79-05282 2A

STORM WATER
Storm-Water Data for Bear Creek Basin, Jackson County, Oregon, 1977-78,
W79-05171 5B

Stormwater Management Model: Transfer of Technology,
W79-05412 5B

STORMS
Record Winter Storms in Illinois, 1977-1978,
W79-05013 2B

STREAMFLOW
Wear of Unsound Pebbles in River Headwaters,
W79-05016 2J

Simulated Streamflow Response to Possible Differences in Transpiration Among Species of Hardwood Trees,
W79-05018 2A

Trends in Streamflow Due to Upstream Land-Use Changes,
W79-05147 2E

Scour and Fill in a Stream Channel, East Fork River, Western Wyoming,
W79-05149 2J

Evaluation and Design of a Streamflow-Data Network in Washington,
W79-05159 7A

Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

STREAMS
A Geographically Variable Water Quality Index Used in Oregon,
W79-05043 5B

Mixing Model for Large Streams,
W79-05133 5B

Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

7-Day Low Flows and Flow Duration of Alabama Streams Through 1973,
W79-05166 2E

STRIP MINES
Copper, Nickel, and Zinc Released from Acid Coal Mine Spoil Materials of Eastern Kentucky,
W79-05044 5A

SUBSIDENCE
Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

SUBSURFACE DRAINAGE
Transient Subsurface Drainage on Sloping Irrigated Land,
W79-05052 6A

Subsurface Drainage of an Alluvial Clay Soil for Soybeans,
W79-05053 4B

SUBSURFACE IRRIGATION
Irrigation Apparatus,
W79-05389 3F

SUCCESSION
Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

SULFITE LIQUORS
Determination of Chloride in Sulfite Pulp Mill Effluents (Chloridbestimmung in Sulfitzellstoff-Ablaugen),
W79-05432 5A

A Rapid Estimation of 5-Day BOD of Spent Sulfite Liquor,
W79-05500 5A

SULFONATES
Effect of DBS Detergent on Activity of Some Enzymes of Young Carp (Cyprinus carpio L.) Brain, Gills and Serum,
W79-05177 5C

SULFUR
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

SULFUR DIOXIDE
Effect of Sulfur Dioxide on Algae,
W79-05352 5C

SUNFISHES
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

SUPERSATURATION
Survival of Salmon Smolts in Sea Water After Exposure to Air-Supersaturated Water,
W79-05191 5B

SURFACE IRRIGATION
Automation of Surface Irrigation,
W79-05305 3F

Practical Surface Irrigation,
W79-05306 3F

Measuring Efficiency of Surface Irrigation Systems,
W79-05307 3F

SURFACE RUNOFF
Surface Runoff from Sludge-Amended Soils,
W79-05041 5B

Movement of Pesticides and Nutrients with Water and Sediment as Affected by Tillage Practices: A Field Study,
W79-05050 5B

Controlling Irrigation Runoff Losses with Proper Management,
W79-05059 4A

Land Use Effects on Claypan Soil Hydrology,
W79-05063 4A

Nonpoint Source Pollution from Coastal Plain Soils in Delaware,
W79-05065 5B

Sedroute Procedure for Estimating Erosion and Sediment Impacts,
W79-05066 2J

SURFACE WATERS
Water Resources Data for Montana, Water Year 1977,
W79-05162 7C

SURVEYS
Results of a Preliminary Survey of Candidate Communities for Saline Water Demineralization Applications.
W79-05077 3A

SURVIVAL
Effects of Continuous Zinc Exposure on Sockeye Salmon During Adult-to-Smolt Freshwater Residency,
W79-05203 5C

SUSPENDED SOLIDS
Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

Method of Clarifying and Removing Water from Water-Solids Suspensions,
W79-05383 5D

SYMBIOSIS
Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

SYSTEMS ANALYSIS
Analysis and Optimization of a Reverse Osmosis Water Purification System,
W79-05073 3A

Mathematical Modeling of Water Quality,
W79-05273 6A

TAUTOG
Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

TAUTOGA
Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

TECHNOLOGY
Endogenous Bias in Technical Progress and Environmental Policy,
W79-05319 6B

TECHNOLOGY TRANSFER
Water Knowledge Transfer: Proceedings, Second International Conference on Transfer of Water Resources Knowledge, June 1977, Fort Collins, Colo.,
W79-05409 10D

Stormwater Management Model: Transfer of Technology,
W79-05412 5B

TEHRAN (IRAN)
A Non-Linear Optimization Method for the Estimation of Aquifer Parameters,
W79-05026 2F

TERATOGENS
Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

TERRACING
Sedimentation Modeling of Impoundment Terraces,
W79-05039 2J

TEST WELLS
Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado, 1975-76,
W79-05164 2F

TESTING
Operation and Maintenance of 37,000 GPD Thin-Film Distillation Pilot Plant.
W79-05079 3A

TESTING PROCEDURES
Development and Evaluation of a Two-Step Membrane Filter Method for Fecal Coliform Recovery in Chlorinated Sewage Effluents,
W79-05012 5A

Test Manual (Tentative) for Permselective Membranes.
W79-05086 3A

Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

TETRASPORANGIA
The Short Day Response in Acrosymphyton Purpuriferum (J. Ag.) Sjost. (Rhodophyceae, Crytonemiales),
W79-05325 5C

TEXAS
The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume I.
W79-05014 2F

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

TEXTILE MILL EFFLUENTS
Microbial Degradation of Dye Wastes in Aqueous Effluents,
W79-05048 5D

TEXTILE WASTES
Identification of Major Organic Constituents in Textile Waste Water Resulting from the Use of Sulfur Dyes,
W79-05230 5B

THALLI
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

THEORETICAL ANALYSIS
Internal Waves in a Circular Channel,
W79-05250 2H

Comparison Theorems for Gravity Waves in Basins of Variable Depth,
W79-05253 2H

THERAGRA
Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

THERMAL PLUMES
Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

THERMAL POLLUTION
Predicting Effects of Cold Shock: Modeling the Decline of a Thermal Plume,
W79-05094 5B

Application of Phased Cooling to a Once-Through Cooling System,
W79-05227 5B

Rejection of Waste Heat from Power Plants Through Phased-Cooling,
W79-05228 5B

THERMAL POWERPLANTS
Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

THERMAL PROPERTIES
Investigation of Thermal Diffusion for Saline Water Conversion,
W79-05361 3A

Investigation of the Availability of Geothermal Energy for the Demineralization of Saline Water,
W79-05367 3A

THERMAL STRESS
Predicting Effects of Cold Shock: Modeling the Decline of a Thermal Plume,
W79-05094 5B

THERMODYNAMICS
Thermodynamic Properties of Saline Water,
W79-05359 3A

THIN FILMS
Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

TIDAL EFFECTS
Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

TIDAL STREAMS
Conceptual Review and Preliminary Design of Multifarious Water Intake Structures,
W79-05248 8A

TILAPIA
Predicting Nighttime Dissolved Oxygen Decline in Ponds Used for Tilapia Culture,
W79-05200 5B

TILLAGE
Movement of Pesticides and Nutrients with Water and Sediment as Affected by Tillage Practices: A Field Study,
W79-05050 5B

TISSUE ANALYSIS
Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

Pollution-Associated Diseases and Abnormalities of Fish and Shellfish: A Review,
W79-05097 5C

Histopathological Changes in the Fish After Intoxication with Non-Ionogenic Tensides on the Basis of Ethoxyl Aducts of Isononylphenols (Histopatologicke Zmeny u Ryb Po Intoxikaci Neionogennimi Tenzidy na Bazi Ethoxylovych Aduktu Isononylfenolu),
W79-05099 5C

Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

Analysis of Chlorinated Hydrocarbon Pollutants: A Simplified Extraction and Cleanup Procedure for Fishery Products,
W79-05110 5A

Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

Effect of DBS Detergent on Activity of Some Enzymes of Young Carp (Cyprinus carpio L.) Brain, Gills and Serum,
W79-05177 5C

Comparative Studies on Methods for Determining Total Mercury in Fish. Dithizone and Flameless Atomic Absorption Spectrophotometry Techniques,
W79-05183 5B

Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

TOXICITY
Copper, Nickel, and Zinc Released from Acid Coal Mine Spoil Materials of Eastern Kentucky,
W79-05044 5A

Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

Toxicity of Phossy Water to Selected Freshwater Organisms,
W79-05095 5B

Pollution-Associated Diseases and Abnormalities of Fish and Shellfish: A Review,
W79-05097 5C

Histopathological Changes in the Fish After Intoxication with Non-Ionogenic Tensides on the Basis of Ethoxyl Aducts of Isononylphenols (Histopatologicke Zmeny u Ryb Po Intoxikaci Neionogennimi Tenzidy na Bazi Ethoxylovych Aduktu Isononylfenolu),
W79-05099 5C

Behavioral Toxicology and Teleost Fish,
W79-05100 5C

Influence of Dilution Water on the Toxicity of Kraft Pulp and Paper Mill Effluent, Including Mechanisms of Effect,
W79-05105 5A

Toxicity of Copper to Cutthroat Trout (Salmo Clarki) Under Different Conditions of Alkalinity, pH, and Hardness,
W79-05107 5A

A Bioassay Laboratory Boat with Comparisons of Central Vs. Boat Laboratory Bioassay Evaluations,
W79-05111 5A

Rapid Vacuum Method for Removal of Mucus from the Epidermis of Fishes,
W79-05180 5A

Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

Effects of Continuous Zinc Exposure on Sockeye Salmon During Adult-to-Smolt Freshwater Residency,
W79-05203 5C

A Mercury Buffer for Toxicity Experiments with Green Algae,
W79-05210 5A

Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

Distribution and Dynamics of Heavy Metals in Alaskan Shelf Environments Subject to Oil Development,
W79-05219 5C

Activity-Directed Fractionation of Petroleum Samples,
W79-05223 5C

Effect of Sulfur Dioxide on Algae,
W79-05352 5C

Development of a Practical Method to Reduce the Toxicity of Kraft Mill Effluents by Retaining some of the Toxic Materials with the Pulp,
W79-05424 5D

Toxicity of Treated and Untreated P. (Pinus) Radiata TMP (Thermomechanical Pulping) Effluents on a Number of Organisms,
W79-05426 5C

Toxicity Screening of Fifteen Chlorinated and Brominated Compounds Using Four Species of Marine Phytoplankton,
W79-05457 5C

TRANSFER KNOWLEDGE
A Multidisciplinary Transfer Model for Water Management Knowledge Transfer in Developing Countries,
W79-05411 6A

TRANSLOCATION
The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

TRANSMISSIVITY
A Non-Linear Optimization Method for the Estimation of Aquifer Parameters,
W79-05026 2F

TRANSPIRATION
Effect of Transpiration Rate on the Uptake of Mineral Elements by Alfalfa Plants (In Bulgarian),
W79-05321 2I

TRAVELING SCREENS
Conceptual Review and Preliminary Design of Multifarious Water Intake Structures,
W79-05248 8A

TREATMENT FACILITIES
Primary Effluent Treatment at Domtar (Fine Papers Ltd.) Cornwall Mill,
W79-05418 5D

Effluent Treatment at Prince George Pulp and Paper Ltd.,
W79-05419 5D

TRICKLE IRRIGATION
Simulated Flow Rate Requirements for Some Flushing Emitters,
W79-05062 8B

Evaluation Criteria for Trickle Irrigation Emission Devices,
W79-05309 3F

Trickle Design for Midwest Conditions,
W79-05310 3F

Trickle Irrigation in Humid Zones,
W79-05311 3F

TROPHIC LEVEL
Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

TROPICAL REGIONS
The Development of Overland Flow in a Tropical Rainforest Catchment,
W79-05030 2A

TRUCKEE RIVER BASIN
Flood and Related Debris Flow Hazards Map,
W79-05165 7C

TUAPAKA CATCHMENT (NEW ZEALAND)
Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

TUNA
Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

TUNDRA
Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

TURBIDITY
The Influence of Turbidity on Net Phytoplankton Photosynthesis in Some Irish Lakes,
W79-05098 5C

TURNERS FALLS DAM
Transportation of Adult American Shad Past Dams on the Connecticut River, Massachusetts, 1973-76,
W79-05174 5C

TYCHOPLANKTON
Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

U.S. GEOLOGICAL SURVEY
Nebraska Water Data Programs, 1978,
W79-05160 7C

The United States Geological Survey in Alaska: Accomplishments During 1977.
W79-05167 7C

ULOTHRIX ZONATA
Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

ULTIMATE DISPOSAL
Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

ULTRAVIOLET RADIATION
Ultraviolet Disinfection of Municipal Effluents,
W79-05488 5D

UPPER COLORADO RIVER BASIN
Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

URBAN DRAINAGE
Interactive Multiple Objective Optimization,
W79-05092 6A

URBAN RUNOFF
Analysis of Urban Storm-Water-Quality from Seven Basins Near Portland, Oregon,
W79-05156 5B

Storm-Water Data for Bear Creek Basin, Jackson County, Oregon, 1977-78,
W79-05171 5B

URBANIZATION
Evaluation of the Effects of Urbanization on Stormwater Runoff and Quality,
W79-05400 4C

UTAH
Review of Design, Construction, and Operation of Soldier Creek Dam Project, Utah.
W79-05239 8A

UTRICULARIA VULGARIS
Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

VACHE GRASSE CREEK WATERSHED
Water-Quality Investigation of the Vache Grasse Creek Watershed, Sebastian County, Arkansas,
W79-05158 6A

VALIUM
Fingerling American Shad: Effect of Valium, MS-222, and Sodium Chloride on Handling Mortality,
W79-05179 5B

VALUE
An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

VAPOR COMPRESSION DISTILLATION
Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

VARIABILITY
Behavioral Toxicology and Teleost Fish,
W79-05100 5C

VEGETATION EFFECTS
Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forests Streams of Northern California,
W79-05005 5C

Influence of Row Spacing of Grain Sorghum on Ground Cover, Runoff, and Erosion,
W79-05258 3F

VEGETATION ESTABLISHMENT
Better Grasses for Roadsides,
W79-05238 6G

VEGETATIVE REPRODUCTION
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

VIBRIO
Vibrio Cholerae, Vibrio Parahaemolyticus, and other Vibrios: Occurrence and Distribution in Chesapeake Bay,
W79-05104 5C

VIRUSES
Detection of Enteroviruses and Bacterial Pathogens Surviving Standard Sewage Treatment,
W79-05090 5B

VOLCANOES
Some Results from Recent Chemical Studies at Kilauea Volcano, Hawaii,
W79-05003 5A

Fume Compositions Found at Various Stages of Activity at Kilauea Volcano, Hawaii,
W79-05004 5A

WASHINGTON
Evaluation and Design of a Streamflow-Data Network in Washington,
W79-05159 7A

WASTE DISPOSAL
MESA New York Light Project Annual Report for Fiscal Year 1977.
W79-05116 5B

Acoustic Monitoring of Industrial Chemical Waste Release at Deep Water Dump Site 106,
W79-05264 5B

WASTE IDENTIFICATION
Determination of Chloride in Sulfite Pulp Mill Effluents (Chloridbestimmung in Sulfitzellstoff-Ablaugen),
W79-05432 5A

WASTE TREATMENT
Users Manual: Data Storage and Retrieval System for Pilot Wastewater Treatment Research,
W79-05281 7C

WASTE WATER DISPOSAL
Land Application of Waste--Important Alternative,
W79-05032 5E

Land Application of Waste--State of the Art,
W79-05033 5E

Land Application of Waste--An Accident Waiting to Happen,
W79-05126 5B

A Water Demand and Wastewater Disposal Model for Optimum Transfer of Water Resources Technology in Developing Countries,
W79-05413 6D

WASTE WATER TREATMENT
Land Application of Waste--Important Alternative,
W79-05032 5E

Land Application of Waste--State of the Art,
W79-05033 5E

Nitrification with Rotating Biological Contactor Systems,
W79-05047 5D

Land Application of Waste--An Accident Waiting to Happen,
W79-05126 5B

Process for Phosphate Conversion Coating with Treatment of Rinse Water by Reverse Osmosis and Ion Exchange,
W79-05372 5D

Liquid Treatment Process,
W79-05377 5D

Method and Apparatus for Separating Solids from Liquids,
W79-05381 5D

Method of Clarifying and Removing Water from Water-Solids Suspensions,
W79-05383 5D

Treatment of Effluents,
W79-05385 5D

Process for Purifying Waste Water Obtained by a Papermaking Process,
W79-05386 5D

Primary Effluent Treatment at (Consolidated-Bathurst Ltd.) Pontiac (Division, Quebec),
W79-05416 5D

Problems Associated with an Aerated Lagoon,
W79-05417 5D

Primary Effluent Treatment at Domtar (Fine Papers Ltd.) Cornwall Mill,
W79-05418 5D

Effluent Treatment at Prince George Pulp and Paper Ltd.,
W79-05419 5D

The Growth Patterns of Some Enteric Bacteria in a Kraft Pulp Mill/Domestic Sewage Combined Treatment System,
W79-05420 5D

Effect of Process Water Recycle on Pollution Control and Energy Conservation,
W79-05422 3E

Use of the Activated Sludge Process in the Treatment of Thermomechanical Pulping Effluents,
W79-05425 5D

Control of Activated Sludge Bulking During Biological Purification (Regulirovanie prirosta aktivnogo ila pri biologicheskoi ochistke),
W79-05431 5D

Soluble Organic Constituents of Natural Waters and Wastewaters Before and After Chlorination,
W79-05436 5A

WATER ALLOCATION
Connecticut River Diversion: A Case Study in Water Allocation Policy,
W79-05414 6B

The Law of Surface Water Allocation in Georgia,
W79-05415 6E

WATER ANALYSIS
Analysis of Urban Storm-Water-Quality from Seven Basins Near Portland, Oregon,
W79-05156 5B

Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee

River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

Water-Quality Investigation of the Vache Grasse Creek Watershed, Sebastian County, Arkansas,
W79-05158 6A

Measurement of Dissolved Oxygen,
W79-05434 5A

WATER CHEMISTRY

An Example of the Use of Factor Analysis and Cluster Analysis in Groundwater Chemistry Interpretation,
W79-05143 2F

The Riou-Mort a Tributary to the River Lot Polluted by Heavy Metals. I. Preliminary Observations on the Chemistry and Benthic Algae,
W79-05206 5B

Thermodynamic Properties of Saline Water,
W79-05359 3A

Precursors and Mechanisms of Haloform Formation in the Chlorination of Water Supplies,
W79-05438 5A

Reactions of Chlorine, Chlorine Dioxide and Mixtures Thereof with Humic Acid: An Interim Report,
W79-05439 5A

Aqueous Chlorination Products of Polynuclear Aromatic Hydrocarbons,
W79-05440 5A

Reactions in Chlorinated Seawater,
W79-05450 5A

Chlorine Degradation and Halocarbon Production in Estuarine Waters,
W79-05451 5A

Investigation of Halogenated Components Formed From Chlorination of Marine Water,
W79-05452 5A

The Effect of Ammonia Concentration on the Chemistry of Chlorinated Sea Water,
W79-05453 5A

Microbial Degradation of Halogenated Hydrocarbons,
W79-05454 5A

DDT, PCB and Chlorinated Benzenes in the Marine Ecosystem Off Southern California,
W79-05455 5C

Chlorination and Water Treatment for Minimizing Trihalomethanes in Drinking Water,
W79-05474 5C

Formation and Occurrence of Haloforms in Drinking Water in the Federal Republic of Germany,
W79-05475 5C

Optimizing Trihalomethane Analysis,
W79-05476 5A

Evaluation of the Capability of Granular Activated Carbon and Resins to Remove Chlorinated and Other Trace Organics from Treated Drinking Water,
W79-05478 5C

WATER CIRCULATION

Computation of Shallow Water Waves with Hybrid Finite Elements,
W79-05022 2L

Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

WATER CONSERVATION

Societal Attitudes and Resultant Policies Call for Water Conservation,
W79-05301 3F

White Water Recycled at C.I.P. (Canadian International Paper Co.), Dalhousie, N.B.,
W79-05421 3E

Highly Effective Paper-Machine Shower Systems (Vysoko-effektinye Spryskovye Sistemy),
W79-05430 3E

Absolute Solution to Industrial Waste Water Problem--Outfall Prevention (Die absolute Loesung des Industrieabwasser--problems -- Unterbindung des Abflusses),
W79-05433 3E

Bleach Plant Operation,
W79-05497 3E

WATER DEMAND

A Water Demand and Wastewater Disposal Model for Optimum Transfer of Water Resources Technology in Developing Countries,
W79-05413 6D

WATER LEVEL FLUCTUATIONS

Groundwater Levels in Nebraska, 1977,
W79-05150 2F

WATER LEVELS

Groundwater Levels in Nebraska, 1977,
W79-05150 2F

Annual Summary of Ground-Water Conditions in Arizona, Spring 1977 to Spring 1978,
W79-05151 4B

WATER MANAGEMENT (APPLIED)

A Multidisciplinary Transfer Model for Water Management Knowledge Transfer in Developing Countries,
W79-05411 6A

WATER POLLUTION

An Event-Based Stochastic Model of Phosphorus Loading into a Lake,
W79-05021 5B

Ground-Water Pollution--A Status Report,
W79-05120 5C

Ground-Water Pollution--An Imminent Disaster,
W79-05121 5C

Ground-Water Pollution--A Limited Problem,
W79-05122 5B

Ground-Water Quality Standards--A Neutral View,
W79-05123 5B

Ground-Water Quality Standards--Irrelevant,
W79-05125 5B

Storm-Water Data for Bear Creek Basin, Jackson County, Oregon, 1977-78,
W79-05171 5B

Soluble Organic Constituents of Natural Waters and Wastewaters Before and After Chlorination,
W79-05436 5A

Natural and Model Aquatic Humics: Reactions with Chlorine,
W79-05437 5C

Aqueous Chlorination of Some Phenolic Acids,
W79-05441 5C

Influence of Chlorine Form and Ambient Temperature on the Toxicity of Intermittent Chlorination to Freshwater Fish,
W79-05445 5C

Avoidance of Monochloramine: Test Tank Results for Rainbow Trout, Coho Salmon, Alewife, Yellow Perch and Spottail Shiner,
W79-05447 5C

Investigation of the Effects of Halogenated Organic Compounds Produced in Cooling Systems and Process Effluents on Aquatic Organisms,
W79-05448 5C

Brominated Compounds Found in Waste-Treatment Effluents and Their Capacity to Bioaccumulate,
W79-05449 5C

Chlorine Degradation and Halocarbon Production in Estuarine Waters,
W79-05451 5A

Biological and Chemical Effects of Chlorination at Coastal Power Plants,
W79-05456 5C

Continuous Low-Level Chlorination for Marine Fouling Control at Power Stations in the United Kingdom,
W79-05462 5C

Epidemic Problems and Chlorination of Drinking Water and Sewage in the Federal Republic of Germany,
W79-05471 5C

Worldwide Aspects of Water Chlorination,
W79-05472 5C

Risk Assessment of the Health Effects of Water Chlorination,
W79-05473 5C

WATER POLLUTION CONTROL

The Federal Ground-Water Protection Program--A Review,
W79-05127 5G

The Federal Ground-Water Protection Program--Today's Hope,
W79-05128 5G

The Federal Ground-Water Protection Program--Tomorrow's Undoing,
W79-05129 5G

State Ground-Water Protection Programs--A National Summary,
W79-05130 5G

State Ground-Water Protection Programs--Inadequate,
W79-05131 5G

State Ground-Water Protection Programs--Adequate,
W79-05132 5G

Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

The German Federal Law on Wastewater Charges,
W79-05315 6E

A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

Algae and Water Pollution,
W79-05322 5C

Ballasted Floating Barrier Boom,
W79-05376 5G

Floating-Refuse-Collecting Boat,
W79-05380 5G

Remote Sensing for Oil Pollution Control Along Coastal Waters of the United States,
W79-05393 7B

Image Enhancement of Side-Scan Sonar Mapping,
W79-05395 7B

The Use of Landsat Imagery for Marine Pollution Studies,
W79-05396 7B

Effect of Process Water Recycle on Pollution Control and Energy Conservation,
W79-05422 3E

Development of a Practical Method to Reduce the Toxicity of Kraft Mill Effluents by Retaining some of the Toxic Materials with the Pulp,
W79-05424 5D

Absolute Solution to Industrial Waste Water Problem--Outfall Prevention (Die absolute Loesung des Industrieabwasser--problems -- Unterbindung des Abflusses),
W79-05433 3E

WATER POLLUTION EFFECTS

MESA New York Light Project Annual Report for Fiscal Year 1977.
W79-05116 5B

Rapid Vacuum Method for Removal of Mucus from the Epidermis of Fishes,
W79-05180 5A

Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

Editorial Introduction,
W79-05188 5A

The Amoco Cadiz Oil Spill-Lines of Study and Early Observations,
W79-05189 5A

The Ecological Impact on and Near Shores by the Amoco Cadiz Oil Spill,
W79-05190 5B

Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

Notes on the Condition in September 1978 of Some Intertidal Sands Polluted by Amoco Cadiz Oil,
W79-05193 5B

Preliminary Observations on Pollution of the Sea Bed and Disturbance of Sub-Littoral Communities in Northern Brittany by Oil from the Amoco Cadiz,
W79-05194 5B

The Amoco Cadiz Oil Spill. A Summary of Observations Made By U.S. Scientists 23 March-10 May, 1978,
W79-05195 5C

Petroleum Hydrocarbon Analyses Conducted Following the Wreck of the Supertanker Amoco Cadiz,
W79-05196 5A

Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

The Effects of Oil on Temperature Regulation in Sea Otters,
W79-05214 5C

Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

The Interaction of Oil with Sea Ice,
W79-05217 5C

Transport Mechanisms and Hydrocarbon Adsorption Properties of Suspended Matter in Lower Cook Inlet,
W79-05218 5C

Distribution and Dynamics of Heavy Metals in Alaskan Shelf Environments Subject to Oil Development,
W79-05219 5C

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05220 5C

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05221 5C

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Continental Shelf,
W79-05222 5C

Activity-Directed Fractionation of Petroleum Samples,
W79-05223 5C

The Transport and Behavior of Oil Spilled in and Under Sea Ice,
W79-05224 5C

Algae and Water Pollution,
W79-05322 5C

Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

Effect of Sulfur Dioxide on Algae,
W79-05352 5C

Influence of Waste Residuals in Estuarine Waters on Development, Behavior and Survival of Soft-Shell Clam Larvae,
W79-05398 5C

Toxicity of Treated and Untreated P. (Pinus) Radiata TMP (Thermomechanical Pulping) Effluents on a Number of Organisms,
W79-05426 5C

WATER POLLUTION SOURCES

Washoff of Herbicides Applied to Corn Residue,
W79-05036 5B

Ground-Water Pollution--A Limited Problem,
W79-05122 5B

Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

WATER POLLUTION TREATMENT

Liquid Treatment Process,
W79-05377 5D

Method of Clarifying and Removing Water from Water-Solids Suspensions,
W79-05383 5D

Polluting Oil Recovery Apparatus,
W79-05390 5G

WATER PURIFICATION

Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

Method of Clarifying and Removing Water from Water-Solids Suspensions,
W79-05383 5D

Process for Purifying Waste Water Obtained by a Papermaking Process,
W79-05386 5D

WATER QUALITY

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume I.
W79-05014 2F

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

Systematic Diurnal Curve Analysis,
W79-05042 5B

A Geographically Variable Water Quality Index Used in Oregon,
W79-05043 5B

The MESA Puget Sound Project, Seattle, Washington. Fiscal year 1977 - Annual Report.
W79-05115 5C

MESA New York Light Project Annual Report for Fiscal Year 1977.
W79-05116 5B

Ground-Water Quality Standards--A Neutral View,
W79-05123 5B

Ground-Water Quality Standards--Relevant,
W79-05124 5B

Summary Appraisals of the Nation's Ground-Water Resources--South Atlantic-Gulf Region,
W79-05154 2F

Analysis of Urban Storm-Water-Quality from Seven Basins Near Portland, Oregon,
W79-05156 5B

Water-Quality Investigation of the Vache Grasse Creek Watershed, Sebastian County, Arkansas.
W79-05158 6A

Nebraska Water Data Programs, 1978,
W79-05160 7C

Water Resources Data for Montana, Water Year 1977,
W79-05162 7C

Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado, 1975-76,
W79-05164 2F

Characteristics of Pennsylvania Recreational Lakes.
W79-05168 2H

Storm-Water Data for Bear Creek Basin, Jackson County, Oregon, 1977-78,
W79-05171 5B

Hatching Table for Fisheries Research,
W79-05178 5A

Non-Point Water Quality Modeling in Wildland Management: A State-of-The-Art Assessment. (Volume I. Text).
W79-05269 5C

Mathematical Modeling of Water Quality,
W79-05273 6A

Urban Rainfall-Runoff-Quality Data Base,
W79-05282 2A

Feasibility Study on Executive Program Development for Basin Ecosystem Modeling,
W79-05285 5G

Kennebec River Corridor Project -- Appendix II: Water Resources,
W79-05404 6B

WATER QUALITY CONTROL

Continuous Simulation for Water Quality Planning,
W79-05010 6B

The Federal Ground-Water Protection Program--A Review,
W79-05127 5G

The Federal Ground-Water Protection Program--Today's Hope,
W79-05128 5G

Algae and Water Pollution,
W79-05322 5C

Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

Ballasted Floating Barrier Boom,
W79-05376 5G

Oil Separation Material,
W79-05378 5G

Floating-Refuse-Collecting Boat,
W79-05380 5G

Process for Purifying Waste Water Obtained by a Papermaking Process,
W79-05386 5D

Polluting Oil Recovery Apparatus,
W79-05390 5G

Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

WATER QUALITY STANDARDS

Ground-Water Quality Standards--A Neutral View,
W79-05123 5B

Ground-Water Quality Standards--Relevant,
W79-05124 5B

Ground-Water Quality Standards--Irrelevant,
W79-05125 5B

WATER REQUIREMENTS

Results of a Preliminary Survey of Candidate Communities for Saline Water Demineralization Applications.
W79-05077 3A

WATER RESOURCES

The United States Geological Survey in Alaska: Accomplishments During 1977.
W79-05167 7C

Collective Decision Making in Water Resource Planning,
W79-05274 6A

A Conceptual Model of the Knowledge Transfer Process,
W79-05410 10D

WATER RESOURCES DEVELOPMENT

Results of a Preliminary Survey of Candidate Communities for Saline Water Demineralization Applications.
W79-05077 3A

Nebraska Water Data Programs, 1978,
W79-05160 7C

Kennebec River Corridor Plan -- A Management Plan for a Rejuvenated Resource,
W79-05402 6B

WATER RESOURCES MANAGEMENT

Kennebec River Corridor Plan -- A Management Plan for a Rejuvenated Resource,
W79-05402 6B

Kennebec River Corridor Project -- Appendix I: Demography,
W79-05403 6B

Kennebec River Corridor Project -- Appendix II: Water Resources,
W79-05404 6B

WATER REUSE

Process for Phosphate Conversion Coating with Treatment of Rinse Water by Reverse Osmosis and Ion Exchange,
W79-05372 5D

WATER RIGHTS

The Law of Surface Water Allocation in Georgia,
W79-05415 6E

WATER SUPPLY

Institutional Arrangements for Effective Water Management in Colorado,
W79-05049 6E

Summary Appraisals of the Nation's Ground-Water Resources--Missouri Basin Region,
W79-05152 7C

Biscayne Aquifer, Southeast Florida,
W79-05155 5B

Kennebec River Corridor Project -- Appendix II: Water Resources,
W79-05404 6B

Kennebec River Corridor Project -- Appendix III: Flow Regulation,
W79-05405 6B

Survey on Sesayap River as Possible Water Resource for a Pulp and Paper Mill (In Indonesia) (Survai sungai Sesayap dan kemungkinannya sebagai sumber air untrk pabrik pulp dan kertas),
W79-05427 6D

WATER TABLE

Drainage Rates and Water-Table Depths,
W79-05137 2G

WATER TEMPERATURE

Predicting Effects of Cold Shock: Modeling the Decline of a Thermal Plume,
W79-05094 5B

Effect of Thermal Increases of Short Duration on Survival of Euphausia Pacifica,
W79-05101 5C

Extreme Temperature Tolerance of Palaemon Serratus (Pennant): Influence of Size and Acclimation) Tolerance Aux Temperatures Extremes de Palaemon Serratus (Pennant): Influence de la Taille et de L'Acclimatation,
W79-05102 5C

Palaemonid Shrimp, Macrobrachium Amazonicum: Effects of Salinity and Temperature on Survival,
W79-05181 5B

Modifications of Temperature Avoidance Troughs for Testing Small Fishes,
W79-05185 5A

Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

A Mathematical Model for Predicting River Temperatures--Application to the Green River below Flaming Gorge Dam,
W79-05283 2H

Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

WATER TREATMENT

Fate of Metal Ions During Domestic Treatment of Water Containing Organics,
W79-05046 5F

Ionization Chamber for Water Treatment System,
W79-05384 5F

Process for Inhibiting Corrosion of Metals in Aqueous Systems,
W79-05391 5F

Ozone, Chlorine Dioxide and Chloramines as Alternatives to Chlorine for Disinfection of Drinking Water,
W79-05477 5C

Trihalomethane Formation from Iodine and Chlorine Disinfection of Ohio River Water,
W79-05479 5C

The Effect of Preozonation on Chloroform Production in the Chlorine Disinfection Process,
W79-05480 5C

Trihalomethane Reduction at the Louisville Water Company,
W79-05481 5C

Chlorine Dioxide Destruction of Viruses and Bacteria in Water,
W79-05486 5C

Chlorine and Activated Carbon Treatment for Removal of Toxic Substances From Water,
W79-05487 5C

Ultraviolet Disinfection of Municipal Effluents,
W79-05488 5D

Biofouling Control Alternatives to Chlorine for Power Plant Cooling Water Systems: An Overview,
W79-05492 5C

Controlling Iron Oxide Deposition in Boiler Systems,
W79-05498 3C

Boiler Water Treatment: Is the Paper Industry A Special Case,
W79-05499 5F

WATER VALUES

The Economic Value of Irrigation Water in the Western United States: An Application of Ridge Regression,
W79-05399 6B

WATER WELLS
Radial Dispersion to an Abstraction Well,
W79-05027 2F

Groundwater Levels in Nebraska, 1977,
W79-05150 2F

WATER YIELD
Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado, 1975-76,
W79-05164 2F

WATERSHED MANAGEMENT
Water-Quality Investigation of the Vache Grasse Creek Watershed, Sebastian County, Arkansas,
W79-05158 6A

WATERSHEDS (BASINS)
Sediment Characteristics and Transport from Northwest Rangeland Watersheds,
W79-05035 2J

Non-Point Water Quality Modeling in Wildland Management: A State-of-the-Art Assessment (Volume II - Appendixes).
W79-05270 5G

Development of a Hydrologic Model for a Canadian Watershed,
W79-05280 2A

WAVE MODES
Internal Waves in a Circular Channel,
W79-05250 2H

WAVES (WATER)
Computation of Shallow Water Waves with Hybrid Finite Elements,
W79-05022 2L

The Growth and Decay of a Hydraulic Jump,
W79-05146 8B

Internal Waves in a Circular Channel,
W79-05250 2H

Comparison Theorems for Gravity Waves in Basins of Variable Depth,
W79-05253 2H

Wave-Current Interaction Models for Rip Currents,
W79-05267 2L

WEATHERED OIL
Activity-Directed Fractionation of Petroleum Samples,
W79-05223 5C

WEATHERING
Weathering Tests of Plastics and Design of Suspended Envelope Solar Stills,
W79-05371 3A

WEST GERMANY
The German Federal Law on Wastewater Charges,
W79-05315 6E

WEST POINT LAKE
Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

WESTERN U.S.
Water Production Functions for Irrigated Agriculture,
W79-05275 3F

WHEAT
Growth Rhythms of Wheat Vegetative Organs and the Effect of Drought on Them (In Russian),
W79-05327 2I

WHITE WATER (PAPER MACHINES)
White Water Recycled at C.I.P. (Canadian International Paper Co.), Dalhousie, N.B.,
W79-05421 3E

WILDLAND MANAGEMENT
Non-Point Water Quality Modeling in Wildland Management: A State-of-The-Art Assessment. (Volume I. Text).
W79-05269 5C

Non-Point Water Quality Modeling in Wildland Management: A State-of-the-Art Assessment (Volume II - Appendixes).
W79-05270 5G

WILLAMETTE RIVER (OR)
A Geographically Variable Water Quality Index Used in Oregon,
W79-05043 5B

WILLINGNESS-TO-PAY
An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

WIND
Wind Correction Method and Apparatus for Irrigation Systems,
W79-05379 3F

WINDS
Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

WINTER
Record Winter Storms in Illinois, 1977-1978,
W79-05013 2B

WINTER STORMS
Record Winter Storms in Illinois, 1977-1978,
W79-05013 2B

WIPED FILM EVAPORATOR
Economic and Technical Evaluation of the Wiped Film Evaporator,
W79-05358 3A

WISCONSIN
Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

WITHDRAWAL
Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska,
W79-05161 4B

YAMPA RIVER BASIN
Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

ZINC
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

Effects of Continuous Zinc Exposure on Sockeye Salmon During Adult-to-Smolt Freshwater Residency,
W79-05203 5C

The Riou-Mort a Tributary to the River Lot Polluted by Heavy Metals. I. Preliminary Observations on the Chemistry and Benthic Algae,
W79-05206 5B

Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

ZOOPLANKTON
Effect of Thermal Increases of Short Duration on Survival of Euphausia Pacifica,
W79-05101 5C

Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

Modified Neuston Net for Collecting Live Larval and Juvenile Fish,
W79-05211 5A

Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

Population Dynamics and Production of a Planktonic Marine Copepod, Acartia Clausii, in a Small Temperate Lagoon on San Juan Island, Washington,
W79-05346 5C

Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

AUTHOR INDEX

ABRAMSON, C. I.
Behavioral Toxicology and Teleost Fish,
W79-05100 5C

ADAMS, C. M. JR.
Solidification and Separation of Ice from Saline Water,
W79-05357 3A

ADAMS, J.
Wear of Unsound Pebbles in River Headwaters,
W79-05016 2J

ADAMS, J. E.
Influence of Row Spacing of Grain Sorghum on Ground Cover, Runoff, and Erosion,
W79-05258 3F

AINLEY, D. G.
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05221 5C

AL-MASHIDANI, G.
A Simple Version of Gumbel's Method for Flood Estimation,
W79-05256 2E

AL-NIAMI, A. N. S.
Finite-Difference Solutions for One-Dimensional Dispersion Using an Improved Mesh Design,
W79-05028 2F

Radial Dispersion to an Abstraction Well,
W79-05027 2F

ALAVANJA, M.
A Case Control Study of Gastrointestinal and Urinary Tract Cancer Mortality and Drinking Water Chlorination,
W79-05465 5C

ALEKSEEVA, A. E.
Water Demand and Yield of Grain Crops in Cultivation Systems of Different Intensity, (In Russian),
W79-05336 2I

ALEXANDER, G. H.
A Solar-Powered Pump for Irrigation,
W79-05287 3F

ALEXANDER, J. E.
Heavy Metal Concentrations at the Apex of the New York Bight,
W79-05117 5A

ALEXANDER, M.
Effect of Sulfur Dioxide on Algae,
W79-05352 5C

ALJIBURY, F. K.
Introduction to Irrigation Efficiency and Scheduling,
W79-05300 3F

Water Efficiency with Deficit and Suboptimal Irrigation,
W79-05302 3F

ALLEN, C. J.
Silt Barriers as Erosion Pollution Control in a Large Recreational Lake,
W79-05237 4D

ALLGEIER, G. D.
Trihalomethane Reduction at the Louisville Water Company,
W79-05481 5C

ANDERSON, G. S.
Summary Appraisals of the Nation's Ground-Water Resources--Alaska,
W79-05153 2F

ANDERSON, J. S.
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Continental Shelf,
W79-05222 5C

ANDERSON, J. W.
Activity-Directed Fractionation of Petroleum Samples,
W79-05223 5C

ANDERSON, R. E.
Economic and Technical Evaluation of the Wiped Film Evaporator,
W79-05358 3A

ANDREWS, E. D.
Scour and Fill in a Stream Channel, East Fork River, Western Wyoming,
W79-05149 2J

ANDREWS, J. W.
Fingerling American Shad: Effect of Valium, MS-222, and Sodium Chloride on Handling Mortality,
W79-05179 5B

ANIKIEV, V. V.
Effect of Soil Humidity on Nitrate Reductase Activity in Barley Shoot Leaves (In Russian),
W79-05314 2I

APRIL, G. C.
Mobile Bay Hydrography Under Flood Stage Conditions,
W79-05008 2L

ARBUCKLE, A. N.
Trihalomethane Reduction at the Louisville Water Company,
W79-05481 5C

ARNDT, K. E.
Water Drive System for a Center Pivot Irrigation Unit or the Like,
W79-05387 3F

ARONSON, D. A.
Artificial Recharge on Long Island, New York,
W79-05169 4B

ASAKAWA, H.
Floating-Refuse-Collecting Boat,
W79-05380 5G

ASHLEY, R. P.
An Example of the Use of Factor Analysis and Cluster Analysis in Groundwater Chemistry Interpretation,
W79-05143 2F

ATCHINSON, G. J.
Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

ATLAS, R. M.
Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development,
W79-05212 5C

AUGENFELD, J. M.
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Continental Shelf,
W79-05222 5C

AUMEN, N. G.
Dissolved Glucose in a Bayou Estuary, Possible Sources and Utilization by Bacteria,
W79-05397 5C

BAKER, J. L.
Movement of Pesticides and Nutrients with Water and Sediment as Affected by Tillage Practices: A Field Study,
W79-05050 5B

Plant Nutrient Losses from Foliar-Fertilized Soybeans,
W79-05056 5G

Washoff of Herbicides Applied to Corn Residue,
W79-05036 5B

BAKER, R. J.
Survival of Salmon Smolts in Sea Water After Exposure to Air-Supersaturated Water,
W79-05191 5B

BALLANCE, R. C.
Worldwide Aspects of Water Chlorination,
W79-05472 5C

BARGH, B. J.
Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

BARINAS, F. A.
Pressure Losses Across Trickle Irrigation Fittings and Emitters,
W79-05060 8B

BARKER, J. L.
Characteristics of Pennsylvania Recreational Lakes,
W79-05168 2H

BARKLEY, R. M.
Generation of Volatile Organic Compounds from Nonvolatile Precursors in Water by Treatment with Chlorine or Ozone,
W79-05482 5C

BARKMAN, L. O.
Process for Purifying Waste Water Obtained by a Papermaking Process,
W79-05386 5D

BARNES, P. L.
Predicting Dispersion Coefficients in Soils,
W79-05067 2G

BARNETT, A. P.
Soil Erosion and Sediment Movement Under Sugarcane Culture on the Flat Lands of Southern Louisiana,
W79-05038 2J

BARNHISEL, R. I.
Copper, Nickel, and Zinc Released from Acid Coal Mine Spoil Materials of Eastern Kentucky,
W79-05044 5A

BARTELT, R. E.
State Ground-Water Protection Programs--A National Summary,
W79-05130 5G

BARTOO, H. W.
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

BATES, R. C.
Development of Resistant Poliovirus by Repetitive Sublethal Exposure to Chlorine,
W79-05470 5C

BATHURST, J. C.
Flow Resistance of Large-Scale Roughness,
W79-05141 2E

BATYR, R. A.
Effects of Irrigation Methods on Water Exchange and Crop Capacity in Apple Tree (In Russian),
W79-05382 2I

BAUM, B.
Precursors and Mechanisms of Haloform Formation in the Chlorination of Water Supplies,
W79-05438 5A

BAYLEY, R. W.
Sludge to Land--Economic Considerations for Water Authorities,
W79-05320 6B

BAYNES, S. M.
Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

BEAN, R. M.
Investigation of Halogenated Components Formed From Chlorination of Marine Water,
W79-05452 5A

BEATTIE, BRUCE R.
The Economic Value of Irrigation Water in the Western United States: An Application of Ridge Regression,
W79-05399 6B

BECK, M. B.
Mathematical Modeling of Water Quality,
W79-05273 6A

BECKER, C. D.
Predicting Effects of Cold Shock: Modeling the Decline of a Thermal Plume,
W79-05094 5B

BEDIENT, P. B.
Drainage Density at Index of Watershed Development,
W79-05034 4A

BEEZHOLD, F. L.
Analysis of Chlorinated Hydrocarbon Pollutants: A Simplified Extraction and Cleanup Procedure for Fishery Products,
W79-05110 5A

BELL, G. L.
Characteristics of the Oswego River Plume and Its Influence on the Nearshore Environment,
W79-05118 2E

BELL, J. A.
Method and Apparatus for Separating Solids from Liquids,
W79-05381 5D

BELL, J. B.
The Growth Patterns of Some Enteric Bacteria in a Kraft Pulp Mill/Domestic Sewage Combined Treatment System,
W79-05420 5D

BELYAVSKAYA, E. A.
Reaction of Soybeans to Overflooding of Soil, (In Russian),
W79-05284 2I

BENDER, E. S.
Toxicity of Phossy Water to Selected Freshwater Organisms,
W79-05095 5B

BENNETT, W. R.
Problems Associated with an Aerated Lagoon,
W79-05417 5D

BERG, C. W.
Controlling Irrigation Runoff Losses with Proper Management,
W79-05059 4A

BERNSTEIN, G.
Kennebec River Corridor Project -- Appendix III: Flow Regulation,
W79-05405 6B

Kennebec River Corridor Project -- Appendix V: Management Plan,
W79-05407 6B

BERSTEIN, G.
Kennebec River Corridor Project -- Appendix IV: Flooding,
W79-05406 6B

BEUTEL, J.
Water Efficiency with Deficit and Suboptimal Irrigation,
W79-05302 3F

BEZDEK, J. C.
Simulated Flow Rate Requirements for Some Flushing Emitters,
W79-05062 8B

BIHNKE, R.
An Evaluation of the Status, Life History, and Habitat Requirements of the Endangered and Threatened Fishes of the Upper Colorado River System. Part Two,
W79-05114 5A

BIRCHFIELD, G. E.
A Time-Dependent Model of a Coastal Boundary Layer with Friction,
W79-05263 2H

BLOCK, R. M.
Respiratory and Osmoregulatory Responses of White Perch (Morone Americana) Exposed to Chlorine and Ozone in Estuarine Waters,
W79-05461 5C

BLOOMSBURG, G. L.
Drainage in a Natural Layered Profile by Finite Element Analysis,
W79-05051 2G

BODE, J. J.
Control System for Irrigation Pumps,
W79-05373 3F

BODENNER, D. L.
Aqueous Chlorination Products of Polynuclear Aromatic Hydrocarbons,
W79-05440 5A

BOETTNER, E. A.
The Effect of Preozonation on Chloroform Production in the Chlorine Disinfection Process,
W79-05480 5C

BOGARDI, I.
An Event-Based Stochastic Model of Phosphorus Loading into a Lake,
W79-05021 5B

BOGARDUS, R. B.
Avoidance of Monochloramine: Test Tank Results for Rainbow Trout, Coho Salmon, Alewife, Yellow Perch and Spottail Shiner,
W79-05447 5C

BOHN, B.
Formation and Occurrence of Haloforms in Drinking Water in the Federal Republic of Germany,
W79-05475 5C

BOHONOS, N.
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

BOIES, D. B.
Avoidance of Monochloramine: Test Tank Results for Rainbow Trout, Coho Salmon, Alewife, Yellow Perch and Spottail Shiner,
W79-05447 5C

BONELL, M.
The Development of Overland Flow in a Tropical Rainforest Catchment,
W79-05030 2A

BONGERS, L. H.
Bromine Chloride - An Alternative Biofouling Control Agent for Cooling Water Treatment,
W79-05493 5C

BONNEY, W. A.
Atlantic Salmon Embryos and Fry: Effects of Various Incubation and Rearing Methods on Hatchery Survival and Growth,
W79-05187 5C

BOSWELL, E. H.
Summary Appraisals of the Nation's Ground-Water Resources--South Atlantic-Gulf Region,
W79-05154 2F

BOSWORTH, C. M.
Development of a Direct-Freezing Continuous Wash-Separation Process for Saline Water Conversion,
W79-05364 3A

BOURQUIN, A. W.
Microbial Degradation of Halogenated Hydrocarbons,
W79-05454 5A

BOUVER, H.
Feasibility Study on Executive Program Development for Basin Ecosystem Modeling,
W79-05285 5G

BOYD, C. E.
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

Predicting Nighttime Dissolved Oxygen Decline in Ponds Used for Tilapia Culture,
W79-05200 5B

BRAUD, H. J.
Trickle Irrigation in Humid Zones,
W79-05311 3F

BRENNAN, E. D.
The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-05368 3A

BRESLAU, L. R.
Remote Sensing for Oil Pollution Control Along Coastal Waters of the United States,
W79-05393 7B

BRETT, C. E.
Mobile Bay Hydrography Under Flood Stage Conditions,
W79-05008 2L

BROOKS, A. S.
A Preliminary Look at the Effects of Intermittent Chlorination on Selected Warmwater Fishes,
W79-05443 5C

BROOKS, W. A.
A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

BROUGHTON, R. S.
Drainage Rates and Water-Table Depths,
W79-05137 2G

BROWN, A. J.
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

BROWN, R. S.
Evaluation of the Effects of Urbanization on Stormwater Runoff and Quality,
W79-05400 4C

BROWN, S. L.
Systems for Rapid Ranking of Environmental Pollutants. Selection of Subjects for Scientific and Technical Assessment Reports,
W79-05286 5A

BRUCE, D. A.
IA Sprinkler Test Standards,
W79-05313 3F

BRUHNE, A.
Absolute Solution to Industrial Waste Water Problem--Outfall Prevention (Die absolute Loesung des Industrieabwasser--problems -- Unterbindung des Abflusses),
W79-05433 3E

BRUNO, S. F.
An Annual Phytoplankton Study in Coastal Waters Off Eastern Long Island (Block Island Sound),
W79-05231 5C

BRUSVEN, M. A.
Interacting Effects of Minimum Flow and Fluctuating Shorelines on Benthic Stream Insects,
W79-05233 2E

BUBENZER, G. D.
Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

BUCKNEY, R. T.
Toxicity of Treated and Untreated P. (Pinus) Radiata TMP (Thermomechanical Pulping) Effluents on a Number of Organisms,
W79-05426 5C

BULLOCK, K. W.
Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

BURCH, M. B.
Investigation of the Effects of Halogenated Organic Compounds Produced in Cooling Systems and Process Effluents on Aquatic Organisms,
W79-05448 5C

BURKE, R. III
Collective Decision Making in Water Resource Planning,
W79-05274 6A

BURNETT, E.
Influence of Row Spacing of Grain Sorghum on Ground Cover, Runoff, and Erosion,
W79-05258 3F

BURRELL, D. C.
Distribution and Dynamics of Heavy Metals in Alaskan Shelf Environments Subject to Oil Development,
W79-05219 5C

BURT, O. R.
Defining Upper Limits to Groundwater Development in the Arid West,
W79-05271 4B

BURTON, D. T.
Biofouling Control Alternatives to Chlorine for Power Plant Cooling Water Systems: An Overview,
W79-05492 5C

Bromine Chloride - An Alternative Biofouling Control Agent for Cooling Water Treatment,
W79-05493 5C

Respiratory and Osmoregulatory Responses of White Perch (Morone Americana) Exposed to Chlorine and Ozone in Estuarine Waters,
W79-05461 5C

BURTON, J. H.
The Chemical Composition of Aquatic Macrophytes. II. Amino Acid Composition of the Protein and Non-Protein in Fractions,
W79-05330 5C

BURWELL, R. E.
Land Use Effects on Claypan Soil Hydrology,
W79-05063 4A

BUSCH, J. R.
Controlling Irrigation Runoff Losses with Proper Management,
W79-05059 4A

BUTLER, E. I.
Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

CABIOCH, L.
Preliminary Observations on Pollution of the Sea Bed and Disturbance of Sub-Littoral Communities in Northern Brittany by Oil from the Amoco Cadiz,
W79-05194 5B

CADBURY, C. J.
Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

CADENAS, E.
Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

CAIRNS, J. JR.
The Use of Various Avoidance Indices to Evaluate the Behavioral Response of the Golden Shiner to Components of Total Residual Chlorine,
W79-05446 5C

CAIRNS, R. J. R.
Oil Separation Material,
W79-05378 5G

CAIRO, P. R.
Evaluation of the Capability of Granular Activated Carbon and Resins to Remove Chlorinated and Other Trace Organics from Treated Drinking Water,
W79-05478 5C

CAMERON, D. R.
Variability of Soil Water Retention Curves and Predicted Hydraulic Conductivities on a Small Plot,
W79-05136 2G

CAMP, C. R.
Subsurface Drainage of an Alluvial Clay Soil for Soybeans,
W79-05053 4B

CAMPBELL, K. L.
Modeling Nitrogen Movement in Agricultural Watersheds,
W79-05069 2G

CANNELL, E. B.
Primary Effluent Treatment at (Consolidated-Bathurst Ltd.) Pontiac (Division, Quebec),
W79-05416 5D

CANT, D. J.
Fluvial Processes and Facies Sequences in the Sandy Braided South Saskatchewan River, Canada,
W79-05135 2J

CANTOR, K. P.
The Epidemiologic Approach to the Evaluation of Organics in Drinking Water,
W79-05464 5C

CAPLE, R.
Aqueous Chlorination Products of Polynuclear Aromatic Hydrocarbons,
W79-05440 5A

CAPUZZO, J. M.
Biological and Chemical Effects of Chlorination at Coastal Power Plants,
W79-05456 5C

CARFANGO, S. S.
Development of a Direct-Freezing Continuous Wash-Separation Process for Saline Water Conversion,
W79-05364 3A

CARLSON, R. M.
Aqueous Chlorination Products of Polynuclear Aromatic Hydrocarbons,
W79-05440 5A

CARO-CORDERO, R.
Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

CARPENTER, J. H.
Reactions in Chlorinated Seawater,
W79-05450 5A

CARTER, C. E.
Subsurface Drainage of an Alluvial Clay Soil for Soybeans,
W79-05053 4B

CEDERSTROM, D. J.
Summary Appraisals of the Nation's Ground-Water Resources--South Atlantic-Gulf Region,
W79-05154 2F

CHAKOUMAKOS, C.
Toxicity of Copper to Cutthroat Trout (Salmo Clarki) Under Different Conditions of Alkalinity, pH, and Hardness,
W79-05107 5A

CHANGNON, D.
Record Winter Storms in Illinois, 1977-1978,
W79-05013 2B

CHANGNON, S. A. JR.
Record Winter Storms in Illinois, 1977-1978,
W79-05013 2B

CHAPMAN, G. A.
Effects of Continuous Zinc Exposure on Sockeye Salmon During Adult-to-Smolt Freshwater Residency,
W79-05203 5C

CHASSE, C.
The Ecological Impact on and Near Shores by the Amoco Cadiz Oil Spill,
W79-05190 5B

CHEN, Y. H.
Mathematical Modeling of Sediment Deposition in Reservoirs,
W79-05142 2J

CHERRY, D. S.
Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

CHERRY, D. S.

The Use of Various Avoidance Indices to Evaluate the Behavioral Response of the Golden Shiner to Components of Total Residual Chlorine,
W79-05446 5C

CHERRY, R. N.
Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

CHIENG, S-T.
Drainage Rates and Water-Table Depths,
W79-05137 2G

CHODYNIECKI, A.
Comparative Studies on Methods for Determining Total Mercury in Fish. Dithizone and Flameless Atomic Absorption Spectrophotometry Techniques,
W79-05183 5B

Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

CHONG, Y. J.
The Use of Landsat Imagery for Marine Pollution Studies,
W79-05396 7B

CHRISTMAN, R. F.
Natural and Model Aquatic Humics: Reactions with Chlorine,
W79-05437 5C

CIERESZKO, W.
Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

CINCUTTA, D. A.
Modifications of Temperature Avoidance Troughs for Testing Small Fishes,
W79-05185 5A

CLARK, C. F.
Cost Analysis of Six Water Desalting Processes,
W79-05074 3A

CLARK, D. T.
Ground-Water Pollution--A Limited Problem,
W79-05122 5B

CLARKE, T. L.
Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

COASH, R. J.
Wind Correction Method and Apparatus for Irrigation Systems,
W79-05379 3F

COBURN, C. B.
Development of a Rapid Tissue Bioassay Technique for Screening Pollutant Effects on Fish,
W79-05229 5A

COLE, C. F.
Influence of Waste Residuals in Estuarine Waters on Development, Behavior and Survival of Soft-Shell Clam Larvae,
W79-05398 5C

COLLIS, W. J.
Predicting Nighttime Dissolved Oxygen Decline in Ponds Used for Tilapia Culture,
W79-05200 5B

COLWELL, R. R.
Vibrio Cholerae, Vibrio Parahaemolyticus, and other Vibrios: Occurrence and Distribution in Chesapeake Bay,
W79-05104 5C

CONNELL, W.
A Bioassay Laboratory Boat with Comparisons of Central Vs. Boat Laboratory Bioassay Evaluations,
W79-05111 5A

CONRAD, J. M.
An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

COOK, C. R.
The Impact of Oxygen Delignification System on Screen Room and Bleach Plant Effluents,
W79-05423 3E

COON, M. D.
The Transport and Behavior of Oil Spilled in and Under Sea Ice,
W79-05224 5C

COPE, J. R.
Investigation of the Availability of Geothermal Energy for the Demineralization of Saline Water,
W79-05367 3A

CORNER, E. D. S.
On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

CORSON, S. R.
Refiner Pulp Mill Effluent. Part 2. Composition of Dissolved Solids Fraction,
W79-05496 5B

CORTEL-BREEMAN, A. M.
The Short Day Response in Acrosymphyton Purpuriferum (J. Ag.) Sjost. (Rhodophyceae, Crytonemiales),
W79-05325 5C

COSTA, D.
The Effects of Oil on Temperature Regulation in Sea Otters,
W79-05214 5C

COUGHLAN, J.
Response of Entrained Plankton to Low-Level Chlorination at a Coastal Power Station,
W79-05463 5C

COWLEY, J. E.
A Model Study of St. Marys River Ice Navigation,
W79-05278 2C

COYLE, J. T.
Evaluation of the Capability of Granular Activated Carbon and Resins to Remove Chlorinated and Other Trace Organics from Treated Drinking Water,
W79-05478 5C

CRADDOCK, D. R.
Effect of Thermal Increases of Short Duration on Survival of Euphausia Pacifica,
W79-05101 5C

CRECELIUS, E. A.
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Continental Shelf,
W79-05222 5C

CRISP, C.
Effect of Phosphorus Supply on Algal Biomass in a Turbid Missouri Reservoir,
W79-05001 5C

CRISP, N.
Effect of Phosphorus Supply on Algal Biomass in a Turbid Missouri Reservoir,
W79-05001 5C

CRONIER, S.
Chlorine Dioxide Destruction of Viruses and Bacteria in Water,
W79-05486 5C

CROSBY, E. C.
Evaluation of the Effects of Urbanization on Stormwater Runoff and Quality,
W79-05400 4C

CRUMPTON, W. G.
Dissolved Glucose in a Bayou Estuary, Possible Sources and Utilization by Bacteria,
W79-05397 5C

CUMMING, R. B.
Mutagenicity and Water Chlorination: Prospect and Perspective,
W79-05466 5C

CUMMINGS, R. G.
Defining Upper Limits to Groundwater Development in the Arid West,
W79-05271 4B

CUNNINGHAM, F.
Effect of Phosphorus Supply on Algal Biomass in a Turbid Missouri Reservoir,
W79-05001 5C

CURTIS, L. M.
Factors Influencing System Selection in Humid Regions,
W79-05297 3F

DALRYMPLE, R. A.
Wave-Current Interaction Models for Rip Currents,
W79-05267 2L

DANIEL, T. C.
Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

DAUBA, F.
Changes in the Species Composition of Fish in the River Lot,
W79-05184 5B

DAUVIN, J. C.
Preliminary Observations on Pollution of the Sea Bed and Disturbance of Sub-Littoral Communities in Northern Brittany by Oil from the Amoco Cadiz,
W79-05194 5B

DAVIS, C. L.
Influence of Soil Air and Drainage on Infiltration,
W79-05054 2G

DAVIS, J. A.
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

DAVIS, M. H.
Response of Entrained Plankton to Low-Level Chlorination at a Coastal Power Station,
W79-05463 5C

DAWSON, J. W.
State Ground-Water Protection Programs--Inadequate,
W79-05131 5G

DECOURSEY, D. G.
Erosion Simulation for Land Use Management,
W79-05055 2J

DERCUMAUX, B.
Methods for Determining the Oxygen Consumption of a Fish Under Conditions of Aquatic Semi-Confinement (Methodes de Determination de la Consommation D'Oxygene D'un Poisson Dans Les Conditions Du Semi-Confinement Aquatique),
W79-05112 5A

DICKSON, K. L.
The Use of Various Avoidance Indices to Evaluate the Behavioral Response of the Golden Shiner to Components of Total Residual Chlorine,
W79-05446 5C

DIRKSEN, C.
Laterally Confined Flow from a Point Source at the Surface of an Inhomogeneous Soil Column,
W79-05261 2G

DMITRIEV, A. P.
Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

DOBRA, K. W.
Rapid Vacuum Method for Removal of Mucus from the Epidermis of Fishes,
W79-05180 5A

DOERR, R. L.
Reactions of Chlorine, Chlorine Dioxide and Mixtures Thereof with Humic Acid: An Interim Report,
W79-05439 5A

DONG, J. N.
Hatching Table for Fisheries Research,
W79-05178 5A

DONIGIAN, A. S. JR.
Continuous Simulation for Water Quality Planning,
W79-05010 6B

DOOLEY, A. E.
Soil Erosion and Sediment Movement Under Sugarcane Culture on the Flat Lands of Southern Louisiana,
W79-05038 2J

DOSPEKHOV, B. A.
Water Demand and Yield of Grain Crops in Cultivation Systems of Different Intensity, (In Russian),
W79-05336 2I

DRINKWATER, K.
Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

DROOP, M. R.
Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

DUCKSTEIN, L.
An Event-Based Stochastic Model of Phosphorus Loading into a Lake,
W79-05021 5B

DUELL, R. W.
Better Grasses for Roadsides,
W79-05238 6G

DUKE, H. R.
Electrical Load and Water Management,
W79-05290 3F

DUNNETTE, D. A.
A Geographically Variable Water Quality Index Used in Oregon,
W79-05043 5B

DUNSTALL, T. G.
A Program to Introduce Site-Specific Chlorination Regimes at Ontario Hydro Generating Stations,
W79-05442 5C

DUROCHER, P. P.
Palaemonid Shrimp, Macrobrachium Amazonicum: Effects of Salinity and Temperature on Survival,
W79-05181 5B

DYER, D. F.
Application of Phased Cooling to a Once-Through Cooling System,
W79-05227 5B

EASTBURN, R. P.
Nonpoint Source Pollution from Coastal Plain Soils in Delaware,
W79-05065 5B

ECKERT, J.
A Multidisciplinary Transfer Model for Water Management Knowledge Transfer in Developing Countries,
W79-05411 6A

EGGERS, D. M.
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

EICEMAN , G. A.
Generation of Volatile Organic Compounds from Nonvolatile Precursors in Water by Treatment with Chlorine or Ozone,
W79-05482 5C

EISENHAUER, D. E.
Automation of Surface Irrigation,
W79-05305 3F

ELLIS, J. P.
Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

ELLIS, M. J.
Groundwater Levels in Nebraska, 1977,
W79-05150 2F

ERBACH, D. C.
Washoff of Herbicides Applied to Corn Residue,
W79-05036 5B

ERDMANN, J. B.
Systematic Diurnal Curve Analysis,
W79-05042 5B

ERICKSON, S. J.
Toxicity Screening of Fifteen Chlorinated and Brominated Compounds Using Four Species of Marine Phytoplankton,
W79-05457 5C

ERMAN, D. C.
Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forests Streams of Northern California,
W79-05005 5C

EVILEVICH, M. A.
Control of Activated Sludge Bulking During Biological Purification (Regulirovanie prirosta aktivnogo ila pri biologicheskoi ochistke),
W79-05431 5D

FABUSS, B. M.
Thermodynamic Properties of Saline Water,
W79-05359 3A

FAN, L. T.
Analysis and Optimization of a Reverse Osmosis Water Purification System,
W79-05073 3A

FARQUHAR, G. J.
Behaviour of a Hydrodynamic Finite Element Model,
W79-05020 8B

FARR, W. E.
Dip Basket for Collecting Juvenile Salmon and Trout in Gatewells at Hydroelectric Dams,
W79-05175 5A

FAYE, R. E.
Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

FEDERER, C. A.
Simulated Streamflow Response to Possible Differences in Transpiration Among Species of Hardwood Trees,
W79-05018 2A

FEELY, R. A.
Transport Mechanisms and Hydrocarbon Adsorption Properties of Suspended Matter in Lower Cook Inlet,
W79-05218 5C

FILIPOWSKI, T. R.
Controlling Iron Oxide Deposition in Boiler Systems,
W79-05498 3C

FINKE, L. R.
Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

FINLAY, B. J.
Community Production and Respiration by Ciliated Protozoa in the Benthos of a Small Eutrophic Loch,
W79-05354 5C

FINLAYSON, J. B.
Fume Compositions Found at Various Stages of Activity at Kilauea Volcano, Hawaii,
W79-05004 5A

Some Results from Recent Chemical Studies at Kilauea Volcano, Hawaii,
W79-05003 5A

FINN, W. D. L.
A Finite Element Method for the Diffusion-Convection Equation with Constant Coefficients,
W79-05019 5B

FISCHBACH, P. E.
Automation of Surface Irrigation,
W79-05305 3F

Solar Cell Irrigation,
W79-05308 3F

FISH, G. A.
Users Manual: Data Storage and Retrieval System for Pilot Wastewater Treatment Research,
W79-05281 7C

FITZGERALD, M. G.
Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

FITZSIMMONS, D. W.
Controlling Irrigation Runoff Losses with Proper Management,
W79-05059 4A

FLYNN, E. L. JR.
Kennebec River Corridor Plan -- A Management Plan for a Rejuvenated Resource,
W79-05402 6B

Kennebec River Corridor Project -- Appendix I: Demography,
W79-05403 6B

Kennebec River Corridor Project -- Appendix II: Water Resources,
W79-05404 6B

Kennebec River Corridor Project -- Appendix III: Flow Regulation,
W79-05405 6B

Kennebec River Corridor Project -- Appendix IV: Flooding,
W79-05406 6B

Kennebec River Corridor Project -- Appendix V: Management Plan,
W79-05407 6B

FOGEL, M.
An Event-Based Stochastic Model of Phosphorus Loading into a Lake,
W79-05021 5B

FOMIN, V. A.
Application of Straw in Agriculture in the Arid Steppe Zone of the Northern Kazakh SSR (In Russian),
W79-05343 2G

FORD, H. W.
Bacterial Clogging in Low Pressure Irrigation Systems,
W79-05312 3F

FOROUD, N.
Drainage Rates and Water-Table Depths,
W79-05137 2G

FORSYTHE, S. L.
Users Manual: Data Storage and Retrieval System for Pilot Wastewater Treatment Research,
W79-05281 7C

FOSS, P. O.
Institutional Arrangements for Effective Water Management in Colorado,
W79-05049 6E

FOSTER, I. D. L.
A Multivariate Model of Storm-Period Solute Behaviour,
W79-05144 5B

FRANK, M. D.
The Economic Value of Irrigation Water in the Western United States: An Application of Ridge Regression,
W79-05399 6B

FREEMAN, A. E.
Toxicity Screening of Fifteen Chlorinated and Brominated Compounds Using Four Species of Marine Phytoplankton,
W79-05457 5C

FREVILLE, M.
Methods for Determining the Oxygen Consumption of a Fish Under Conditions of Aquatic Semi-Confinement (Methodes de Determination de la Consommation D'Oxygene D'un Poisson Dans Les Conditions Du Semi-Confinement Aquatique),
W79-05112 5A

FRIEDMAN, A. A.
Development of a Rapid Tissue Bioassay Technique for Screening Pollutant Effects on Fish,
W79-05229 5A

GABRIELS, D.
Size Distribution of Eroded Material from Simulated Rainfall: Effect Over a Range of Texture,
W79-05259 2J

GADD, P. E.
Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

GAMBLE, J.
Trickle Design for Midwest Conditions,
W79-05310 3F

GARCEAU, J. J.
A Rapid Estimation of 5-Day BOD of Spent Sulfite Liquor,
W79-05500 5A

GARDNER, W. S.
Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

GARRETT, M. E.
Liquid Treatment Process,
W79-05377 5D

GARSTANG, M.
Some Aspects of Florida Convective Rainfall,
W79-05139 2B

GENTIL, F.
Preliminary Observations on Pollution of the Sea Bed and Disturbance of Sub-Littoral Communities in Northern Brittany by Oil from the Amoco Cadiz,
W79-05194 5B

GERBER, W. G.
Parametric Cost Studies Pertaining to Dual-Purpose Power and Water Desalination Plants,
W79-05362 3A

GERDTS, M.
Water Efficiency with Deficit and Suboptimal Irrigation,
W79-05302 3F

GIBSON, D. T.
Microbial Degradation of Halogenated Hydrocarbons,
W79-05454 5A

GILEAD, G.
Irrigation Apparatus,
W79-05389 3F

GILLEY, J. R.
Limits of Low Pressure Sprinklers and Spray Nozzles on Center Pivot Applications,
W79-05294 3F

GILMARTIN, M.
The Phytoplankton Characteristics of the Barrier Island Lagoons of the Gulf of California,
W79-05337 5C

GILMOUR, D. A.
The Development of Overland Flow in a Tropical Rainforest Catchment,
W79-05030 2A

GLANCY, P. A.
Flood and Related Debris Flow Hazards Map,
W79-05165 7C

GLAZE, W. H.
Soluble Organic Constituents of Natural Waters and Wastewaters Before and After Chlorination,
W79-05436 5A

GLEDHILL, C.
Influence of Waste Residuals in Estuarine Waters on Development, Behavior and Survival of Soft-Shell Clam Larvae,
W79-05398 5C

GOIT, J. B.
The Applicability of Dual Gamma Scanning to Freezing Soils and the Problem of Stratification,
W79-05260 2C

GOLDMAN, J. C.
Biological and Chemical Effects of Chlorination at Coastal Power Plants,
W79-05456 5C

GOLDSTEIN, I.
A Case Control Study of Gastrointestinal and Urinary Tract Cancer Mortality and Drinking Water Chlorination,
W79-05465 5C

GOMINGER, H. D.
A Bioassay Laboratory Boat with Comparisons of Central Vs. Boat Laboratory Bioassay Evaluations,
W79-05111 5A

GOODE, R. P.
Chlorination and Water Treatment for Minimizing Trihalomethanes in Drinking Water,
W79-05474 5C

GOODLING, J. S.
Rejection of Waste Heat from Power Plants Through Phased-Cooling,
W79-05228 5B

GOODMAN, A. S.
Conceptual Review and Preliminary Design of Multifarious Water Intake Structures,
W79-05248 8A

GORDON, J. R.
Interdisciplinary Team Approach to Mitigating Adverse Environmental Impacts of Highway Construction,
W79-05236 6G

GORIN, J.
Methods for Determining the Oxygen Consumption of a Fish Under Conditions of Aquatic Semi-Confinement (Methodes de Determination de la Consommation D'Oxygene D'un Poisson Dans Les Conditions Du Semi-Confinement Aquatique),
W79-05112 5A

GOSLING, R.
Practical Surface Irrigation,
W79-05306 3F

GRAHAM, P. A.
Distributing Regional Services Costs,
W79-05276 6C

GRANGER, R. J.
Melting of a Prairie Snowpack,
W79-05252 2C

GRAU, C. R.
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05221 5C

GREEN, J. B.
Wastewater Treatment with Humic Acid-Fly Ash Mixtures,
W79-05006 5D

GRIEVE, J. A.
A Program to Introduce Site-Specific Chlorination Regimes at Ontario Hydro Generating Stations,
W79-05442 5C

GRIFFITHS, R. P.
Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05220 5C

GROCH, L.
Histopathological Changes in the Fish After Intoxication with Non-Ionogenic Tensides on the Basis of Ethoxyl Aducts of Isononylphenols (Histopatologicke Zmeny u Ryb Po Intoxikaci Neionogennimi Tenzidy na Bazi Ethoxylovych Aduktu Isononylfenolu),
W79-05099 5C

GRODZINSKY, D. M.
Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

GROENEVELT, P. H.
The Applicability of Dual Gamma Scanning to Freezing Soils and the Problem of Stratification,
W79-05260 2C

GRUGER, E. H. JR.
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

GUCSHA, N. I.
Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

GUEST, W. C.
Palaemonid Shrimp, Macrobrachium Amazonicum: Effects of Salinity and Temperature on Survival,
W79-05181 5B

GULLANS, S. R.
Respiratory and Osmoregulatory Responses of White Perch (Morone Americana) Exposed to Chlorine and Ozone in Estuarine Waters,
W79-05461 5C

GUTHRIE, R. K.
Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

HAACK, L. P.
Generation of Volatile Organic Compounds from Nonvolatile Precursors in Water by Treatment with Chlorine or Ozone,
W79-05482 5C

HAGAN, R. M.
Societal Attitudes and Resultant Policies Call for Water Conservation,
W79-05301 3F

HAJIC, E. J.
Image Enhancement of Side-Scan Sonar Mapping,
W79-05395 7B

HALFF, A. H.
Flood-Plain Management in Dallas, Tex.: 1908-1978,
W79-05272 6F

HALL, R. L.
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

HAMILTON, D. H. JR.
Chlorine Application for the Control of Condenser Fouling,
W79-05489 5C

HANNAFORD, J. F.
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

HANSON, R. E.
Application of End Guns on Center Pivots,
W79-05293 3F

HARDY, R.
Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

HARICHAUX, P.
Methods for Determining the Oxygen Consumption of a Fish Under Conditions of Aquatic Semi-Confinement (Methodes de Determination de la Consommation D'Oxygene D'un Poisson Dans Les Conditions Du Semi-Confinement Aquatique),
W79-05112 5A

HARRINGTON, R. A.
Behaviour of a Hydrodynamic Finite Element Model,
W79-05020 8B

HARTWIG, R. O.
Sedimentation Modeling of Impoundment Terraces,
W79-05039 2J

HASS, J. R.
Natural and Model Aquatic Humics: Reactions with Chlorine,
W79-05437 5C

HATTULA, M. L.
Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

HAUSHILD, W. L.
Evaluation and Design of a Streamflow-Data Network in Washington,
W79-05159 7A

HAWKINS, R. H.
Runoff Curve Numbers with Varying Site Moisture,
W79-05023 2D

HAYDEN, J. W.
A Model Study of St. Marys River Ice Navigation,
W79-05278 2C

HAYES, E. C.
7-Day Low Flows and Flow Duration of Alabama Streams Through 1973,
W79-05166 2E

HAYES, M. O.
Coastal Morphology, Oil Spill Vulnerability and Sedimentology of Kotzebue Sound and Kodiak Island,
W79-05213 5C

HEADY, E. O.
Water Production Functions for Irrigated Agriculture,
W79-05275 3F

HEALY, M.
Spray Nozzle,
W79-05374 3F

HEANEY, J. P.
Collective Decision Making in Water Resource Planning,
W79-05274 6A

Drainage Density at Index of Watershed Development,
W79-05034 4A

Urban Rainfall-Runoff-Quality Data Base,
W79-05282 2A

HEATH, A. G.
Influence of Chlorine Form and Ambient Temperature on the Toxicity of Intermittent Chlorination to Freshwater Fish,
W79-05445 5C

HEERMANN, D. F.
Electrical Load and Water Management,
W79-05290 3F

HEESEN, T. C.
DDT, PCB and Chlorinated Benzenes in the Marine Ecosystem Off Southern California,
W79-05455 5C

HEIMES, F. J.
Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

HELLEBURST, J. A.
Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

HELZ, G. R.
Chlorine Degradation and Halocarbon Production in Estuarine Waters,
W79-05451 5A

HENDRICKSON, H. H.
Research and Development of Processes for Desalting Water by Freezing,
W79-05085 3A

HERRLING, B.
Computation of Shallow Water Waves with Hybrid Finite Elements,
W79-05022 2L

HERSHBERGER, W. K.
Hatching Table for Fisheries Research,
W79-05178 5A

HESS, F. R.
Acoustic Monitoring of Industrial Chemical Waste Release at Deep Water Dump Site 106,
W79-05264 5B

HETRICK, F. M.
Detection of Enteroviruses and Bacterial Pathogens Surviving Standard Sewage Treatment,
W79-05090 5B

HETTLER, W. F.
Modified Neuston Net for Collecting Live Larval and Juvenile Fish,
W79-05211 5A

HEXEM, R. W.
Water Production Functions for Irrigated Agriculture,
W79-05275 3F

HICKEY, P. L.
Hatching Table for Fisheries Research,
W79-05178 5A

HICKMAN, M.
Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

HIGGINS, R. B.
Method and Apparatus for Separating Solids from Liquids,
W79-05381 5D

HINESLY, T. D.
Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

HITCHMAN, M. L.
Measurement of Dissolved Oxygen,
W79-05434 5A

HOCUTT, C. H.
Modifications of Temperature Avoidance Troughs for Testing Small Fishes,
W79-05185 5A

HODGINS, H. O.
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

HOEHN, R. C.
Bromine Chloride as an Alternative Wastewater Disinfectant to Chlorine,
W79-05484 5C

Chlorination and Water Treatment for Minimizing Trihalomethanes in Drinking Water,
W79-05474 5C

HOLDEN, P.
An Evaluation of the Status, Life History, and Habitat Requirements of the Endangered and Threatened Fishes of the Upper Colorado River System. Part Two,
W79-05114 5A

HOLLMAN, R.
Heavy Metal Concentrations at the Apex of the New York Bight,
W79-05117 5A

HOLME, N. A.
Notes on the Condition in September 1978 of Some Intertidal Sands Polluted by Amoco Cadiz Oil,
W79-05193 5B

HOLT, B. R.
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

Systems for Rapid Ranking of Environmental Pollutants. Selection of Subjects for Scientific and Technical Assessment Reports,
W79-05286 5A

HOOVER, J. R.
Influence of Soil Air and Drainage on Infiltration,
W79-05054 2G

HORNBECK, J. W.
Effects of Sludge Applications on Soil Water Solution and Vegetation in a Northern Hardwood Stand,
W79-05002 5E

HORVATH, F. J.
Avoidance of Monochloramine: Test Tank Results for Rainbow Trout, Coho Salmon, Alewife, Yellow Perch and Spottail Shiner,
W79-05447 5C

HORWATH, L.
The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

HOWARD, J. M.
Oil Separation Material,
W79-05378 5G

HOWELL, T. A.
Pressure Losses Across Trickle Irrigation Fittings and Emitters,
W79-05060 8B

HOWLAND, R. G.
Chlorine and Activated Carbon Treatment for Removal of Toxic Substances From Water,
W79-05487 5C

HOYLAND, G.
Sludge to Land--Economic Considerations for Water Authorities,
W79-05320 6B

HSU, R. Y.
Chlorine Degradation and Halocarbon Production in Estuarine Waters,
W79-05451 5A

HU, S.
Mobile Bay Hydrography Under Flood Stage Conditions,
W79-05008 2L

HUANG, JU-CHANG
New Design Criteria for the Aerobic Digestion of Sewage Lime Sludge,
W79-05009 5D

HUBBS, S. A.
Trihalomethane Reduction at the Louisville Water Company,
W79-05481 5C

HUBER, W. C.
Drainage Density at Index of Watershed Development,
W79-05034 4A

Urban Rainfall-Runoff-Quality Data Base,
W79-05282 2A

HUISMAN, J.
A Mercury Buffer for Toxicity Experiments with Green Algae,
W79-05210 5A

HULL, J. E.
Biscayne Aquifer, Southeast Florida,
W79-05155 5B

HULLIGAN, P. M.
Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

HUPFL, J.
Determination of Chloride in Sulfite Pulp Mill Effluents (Chloridbestimmung in Sulfitzellstoff-Ablaugen),
W79-05432 5A

HUTCHINS, F. E.
Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

ICHIKUNI, M.
Calcite as a Source of Excess Calcium in Rainwater,
W79-05262 2K

IGNATENKO, V. G.
Highly Effective Paper-Machine Shower Systems (Vysoko-effektinye Spryskovye Sistemy),
W79-05430 3E

INMAN, G. W. JR.
The Effect of Ammonia Concentration on the Chemistry of Chlorinated Sea Water,
W79-05453 5A

ITO, B. M.
Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

JACKSON, K. S.
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

JAMES, L. D.
Integrating Water Resources and Land Use Planning,
W79-05408 6B

JAN, T-K.
Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

JANATUINEN, J.
Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

JANDA, R. J.
Summary of Watershed Conditions in the Vicinity of Redwood National Park, California,
W79-05170 4D

JARRETT, A. R.
Influence of Soil Air and Drainage on Infiltration,
W79-05054 2G

A Simple Finite Element Method of Infiltration,
W79-05064 2G

JENKERSON, C. G.
Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

JEWSON, D. H.
The Influence of Turbidity on Net Phytoplankton Photosynthesis in Some Irish Lakes,
W79-05098 5C

JOHNSON, A.
Relationship Between Alluvial Soils and Flooding in the Piedmont Lowland of Southeastern Pennsylvania,
W79-05017 2E

JOHNSON, C. C. JR.
Land Application of Waste--An Accident Waiting to Happen,
W79-05126 5B

JOHNSON, C. W.
Reducing Stream Sediment Loads by Irrigation Diversions,
W79-05057 2J

Sediment Characteristics and Transport from Northwest Rangeland Watersheds,
W79-05035 2J

JOHNSON, H. P.
Movement of Pesticides and Nutrients with Water and Sediment as Affected by Tillage Practices: A Field Study,
W79-05050 5B

Sedimentation Modeling of Impoundment Terraces,
W79-05039 2J

Washoff of Herbicides Applied to Corn Residue,
W79-05036 5B

JOHNSON, J. D.
The Effect of Ammonia Concentration on the Chemistry of Chlorinated Sea Water,
W79-05453 5A

Natural and Model Aquatic Humics: Reactions with Chlorine,
W79-05437 5C

JOHNSTON, L. E.
A Program to Introduce Site-Specific Chlorination Regimes at Ontario Hydro Generating Stations,
W79-05442 5C

JOLLY JR, A. L.
Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

JONASSON, I. R.
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

JONES, J. P.
Nonpoint Source Pollution from Coastal Plain Soils in Delaware,
W79-05065 5B

JONES, J. W.
Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

JONES, P. H.
Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

JONES, P. J.
Effect of Phosphorus Supply on Algal Biomass in a Turbid Missouri Reservoir,
W79-05001 5C

JORDEN, R. M.
Evaluation of Alternative Chemical Treatments for Biofouling Control in Electric Power Facilities,
W79-05494 5C

JOSEPH, S. W.
Vibrio Cholerae, Vibrio Parahaemolyticus, and other Vibrios: Occurrence and Distribution in Chesapeake Bay,
W79-05104 5C

JOSEPH, T.
An Evaluation of the Status, Life History, and Habitat Requirements of the Endangered and Threatened Fishes of the Upper Colorado River System. Part Two,
W79-05114 5A

JOYCE, T. M.
The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

JURKOWSKI, M. K.
Effect of DBS Detergent on Activity of Some Enzymes of Young Carp (Cyprinus carpio L.) Brain, Gills and Serum,
W79-05177 5C

JUST, R. E.
A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

KANIVETS, N. I.
Application of Straw in Agriculture in the Arid Steppe Zone of the Northern Kazakh SSR (In Russian),
W79-05343 2G

KAPER, J.
Vibrio Cholerae, Vibrio Parahaemolyticus, and other Vibrios: Occurrence and Distribution in Chesapeake Bay,
W79-05104 5C

KARINEN, J. F.
Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

KARRICK, N. L.
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

KATZER, T. L.
Flood and Related Debris Flow Hazards Map,
W79-05165 7C

KAWARATANI, R.
Evaluation of Alternative Chemical Treatments for Biofouling Control in Electric Power Facilities,
W79-05494 5C

KAY, B. D.
The Applicability of Dual Gamma Scanning to Freezing Soils and the Problem of Stratification,
W79-05260 2C

KAYNOR, E. R.
Connecticut River Diversion: A Case Study in Water Allocation Policy,
W79-05414 6B

KEECH, D. K.
Ground-Water Quality Standards--A Neutral View,
W79-05123 5B

KEENE, R. M.
Liquid Treatment Process,
W79-05377 5D

KEENEY, R. L.
Evaluation of Proposed Storage Sites,
W79-05277 6B

KELLER, J.
Trickle Irrigation Tubing Hydraulics,
W79-05061 8B

KELLEY, B. C.
Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

KELLY, G. D.
Sedroute Procedure for Estimating Erosion and Sediment Impacts,
W79-05066 2J

KELLY, J. A.
Controlling Iron Oxide Deposition in Boiler Systems,
W79-05498 3C

KENNING, B. F. I.
Estimating Design Flows for Urban Drainage,
W79-05024 2E

KERIBAR, R.
Computer Simulation of Bubbler-Induced Melting of Ice Covers Using Experimental Heat Transfer Results,
W79-05279 2C

KESTING, R. E.
Development of DRY-RO Membranes from Sulfonated Cellulose Acetates and Quaternized Cellulose Acetate Carbamates,
W79-05045 3A

KHALANSKI, M.
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

KHANJANI, M. J.
Drainage in a Natural Layered Profile by Finite Element Analysis,
W79-05051 2G

KIEFER, R. W.
Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

KILVINGTON, C. C.
On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

KIMBALL, K. R.
Integrating Water Resources and Land Use Planning,
W79-05408 6B

KIMM, V. J.
The Federal Ground-Water Protection Program--A Review,
W79-05127 5G

KING, L. G.
Transient Subsurface Drainage on Sloping Irrigated Land,
W79-05052 6A

KINMAN, R. N.
Trihalomethane Formation from Iodine and Chlorine Disinfection of Ohio River Water,
W79-05479 5C

KINNER, P. C.
The Use of Species Abundance Estimates in Marine Benthic Studies,
W79-05109 5A

KIRKHAM, T. A.
Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

KIRKWOOD, R. C.
The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

KITE, G. W.
Development of a Hydrologic Model for a Canadian Watershed,
W79-05280 2A

KLADIVKO, E. J.
Surface Runoff from Sludge-Amended Soils,
W79-05041 5B

KLAND, M. J.
A Priori Predictive Methods of Assessing Health Effects of Chemicals in the Environment,
W79-05469 5C

KLECKNER, R. L.
Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

KLEIN, H.
Biscayne Aquifer, Southeast Florida,
W79-05155 5B

KNEBEL, M. E.
Parametric Cost Studies Pertaining to Dual-Purpose Power and Water Desalination Plants,
W79-05362 3A

KNOTT, J. M.
Reconnaissance Assessment of Erosion and Sedimentation in the Canada De Los Alamos Basin, Los Angeles and Ventura Counties, California,
W79-05172 2J

KONDOH, J.
Floating-Refuse-Collecting Boat,
W79-05380 5G

KOOYMAN, G.
The Effects of Oil on Temperature Regulation in Sea Otters,
W79-05214 5C

KORN, S.
Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

KOROVIN, L. K.
Control of Activated Sludge Bulking During Biological Purification (Regulirovanie prirosta aktivnogo ila pri biologicheskoi ochistke),
W79-05431 5D

KOSMAKOVA, V. E.
Reaction of Soybeans to Overflooding of Soil, (In Russian),
W79-05284 2I

KOTERBA, M. T.
Effects of Sludge Applications on Soil Water Solution and Vegetation in a Northern Hardwood Stand,
W79-05002 5E

KOUWEN, N.
Behaviour of a Hydrodynamic Finite Element Model,
W79-05020 8B

KOVACS, A.
Radar Anisotropy of Sea Ice Due to Preferred Azimuthal Orientation of the Horizontal C Axes of Ice Crystals,
W79-05138 2C

KOZEL, T. R.
Rapid Vacuum Method for Removal of Mucus from the Epidermis of Fishes,
W79-05180 5A

KRAMER, L. A.
Land Use Effects on Claypan Soil Hydrology,
W79-05063 4A

KRCMA, R. F.
Dip Basket for Collecting Juvenile Salmon and Trout in Gatewells at Hydroelectric Dams,
W79-05175 5A

KREMER, B. P.
Patterns of Photoassimilatory Products in Pacific Rhodophyceae,
W79-05328 5C

KUDREV, T.
Effect of Transpiration Rate on the Uptake of Mineral Elements by Alfalfa Plants (In Bulgarian),
W79-05321 2I

KUEHL, D. W.
Brominated Compounds Found in Waste-Treatment Effluents and Their Capacity to Bioaccumulate,
W79-05449 5C

KUMM, E. L.
Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

KUNSTNER, W.
Determination of Chloride in Sulfite Pulp Mill Effluents (Chloridbestimmung in Sulfitzellstoff-Ablaugen),
W79-05432 5A

KURAMAGOMEDOV, M. K.
Effect of Soil Humidity on Nitrate Reductase Activity in Barley Shoot Leaves (In Russian),
W79-05314 2I

KUSHINRENKO, M. D.
Effects of Irrigation Methods on Water Exchange and Crop Capacity in Apple Tree (In Russian),
W79-05382 2I

LAFFORGUE, A.
Obtaining Variations of Field Infiltration Capacity from Simulated Rainstorm Experiments (Determination Des Variations De La Capacite D'Absorption D'Un Sol En Place Sous Averses Simulees),
W79-05257 2G

LAFLEN, J. M.
Plant Nutrient Losses from Foliar-Fertilized Soybeans,
W79-05056 5G

Sedimentation Modeling of Impoundment Terraces,
W79-05039 2J

LAMB, T. E.
Water-Quality Investigation of the Vache Grasse Creek Watershed, Sebastian County, Arkansas,
W79-05158 6A

LAMPERTI, L. P.
Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

LANDRY, M. R.
Population Dynamics and Production of a Planktonic Marine Copepod, Acartia Clausii, in a Small Temperate Lagoon on San Juan Island, Washington,
W79-05346 5C

LANG, D. R.
Mutagenicity of Complex Mixtures from Drinking Water,
W79-05468 5C

LANG, M.
The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

LANNERGREN, C.
Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

LAPPALA, E. G.
Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska,
W79-05161 4B

LARRICK, S. R.
The Use of Various Avoidance Indices to Evaluate the Behavioral Response of the Golden Shiner to Components of Total Residual Chlorine,
W79-05446 5C

LARSON, D. T.
Integrating Water Resources and Land Use Planning,
W79-05408 6B

LARSON, G. L.
Toward an Understanding of the Toxicity of Intermittent Exposures of Total Residual Chlorine to Freshwater Fishes,
W79-05444 5C

Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

LARSON, R. A.
Aqueous Chlorination of Some Phenolic Acids,
W79-05441 5C

LASH, D.
Simulated Streamflow Response to Possible Differences in Transpiration Among Species of Hardwood Trees,
W79-05018 2A

LAUBIER, L.
The Amoco Cadiz Oil Spill-Lines of Study and Early Observations,
W79-05189 5A

LAVELLE, J. W.
Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

LAW, R. J.
Petroleum Hydrocarbon Analyses Conducted Following the Wreck of the Supertanker Amoco Cadiz,
W79-05196 5A

LAYZER, J. B.
Transportation of Adult American Shad Past Dams on the Connecticut River, Massachusetts, 1973-76,
W79-05174 5C

LEAN, G. H.
Modeling Two-Dimensional Circulating Flow,
W79-05255 8B

LEBLANC, N. E.
A Comparison of Bromine Chloride and Chlorine as Wastewater Disinfectants in Pilot Plant Studies,
W79-05485 5C

LEE, G. B.
Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

LEE, S. S.
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

LEON, K. A.
Atlantic Salmon Embryos and Fry: Effects of Various Incubation and Rearing Methods on Hatchery Survival and Growth,
W79-05187 5C

LEONARD, E. N.
Brominated Compounds Found in Waste-Treatment Effluents and Their Capacity to Bioaccumulate,
W79-05449 5C

LEONG, L. Y. C.
Optimizing Trihalomethane Analysis,
W79-05476 5A

LEVINE, G.
Boiler Water Treatment: Is the Paper Industry A Special Case,
W79-05499 5F

LEWIN, R. A.
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

LEWIS, G. C.
Controlling Irrigation Runoff Losses with Proper Management,
W79-05059 4A

LEWIS, V.
Fume Compositions Found at Various Stages of Activity at Kilauea Volcano, Hawaii,
W79-05004 5A

LEWIS, V. A.
Some Results from Recent Chemical Studies at Kilauea Volcano, Hawaii,
W79-05003 5A

LIAO, W. T.
Natural and Model Aquatic Humics: Reactions with Chlorine,
W79-05437 5C

LIDEN, L. H.
Biofouling Control Alternatives to Chlorine for Power Plant Cooling Water Systems: An Overview,
W79-05492 5C

Bromine Chloride - An Alternative Biofouling Control Agent for Cooling Water Treatment,
W79-05493 5C

LIETZKE, M. H.
A Kinetic Model for Predicting the Composition of Chlorinated Water Discharged from Power Plant Cooling Systems,
W79-05491 5C

LIN, S. D.
Development and Evaluation of a Two-Step Membrane Filter Method for Fecal Coliform Recovery in Chlorinated Sewage Effluents,
W79-05012 5A

LINDORFF, D. E.
Ground-Water Pollution--A Status Report,
W79-05120 5C

LINSLEY, R. K.
Continuous Simulation for Water Quality Planning,
W79-05010 6B

LITTLE, W. C.
Sea Research Program for Channel Stability and Gully Control,
W79-05068 2J

LLAMA, M. J.
Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

LLOYD, J. A.
Refiner Pulp Mill Effluent. Part 2. Composition of Dissolved Solids Fraction,
W79-05496 5B

LLOYD, J. W.
An Example of the Use of Factor Analysis and Cluster Analysis in Groundwater Chemistry Interpretation,
W79-05143 2F

LO, S. N.
A Rapid Estimation of 5-Day BOD of Spent Sulfite Liquor,
W79-05500 5A

LOCH, J. G. P.
The Applicability of Dual Gamma Scanning to Freezing Soils and the Problem of Stratification,
W79-05260 2C

LOF, G. O. G.
Demineralization of Saline Water with Solar Energy,
W79-05088 3A

Solar Distillation of Sea Water in the Virgin Islands,
W79-05087 3A

LOPER, J. C.
Mutagenicity of Complex Mixtures from Drinking Water,
W79-05468 5C

LOPEZ, J. L.
Mathematical Modeling of Sediment Deposition in Reservoirs,
W79-05142 2J

LOTZ, C. W.
Economic and Technical Evaluation of the Wiped Film Evaporator,
W79-05358 3A

LOZANO, C. J.
Wave-Current Interaction Models for Rip Currents,
W79-05267 2L

LUM, J.
Status of Regulation Development for Cooling Water Discharges from Power Plants,
W79-05495 5C

LUND, J. H.
The Impact of Oxygen Delignification System on Screen Room and Bleach Plant Effluents,
W79-05423 3E

LUNDE, A. T.
A Time-Dependent Model of a Coastal Boundary Layer with Friction,
W79-05263 2H

LUYENDYK, B. P.
Image Enhancement of Side-Scan Sonar Mapping,
W79-05395 7B

MABEU, W. R.
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

MACDONALD, J. R.
Investigation of the Availability of Geothermal Energy for the Demineralization of Saline Water,
W79-05367 3A

MACFARLANE, J. A.
Application of Phased Cooling to a Once-Through Cooling System,
W79-05227 5B

Rejection of Waste Heat from Power Plants Through Phased-Cooling,
W79-05228 5B

MACGREGOR, J. J.
Treatment of Effluents,
W79-05385 5D

MACKIE, P. R.
Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

MACRAE, W.
The Growth Patterns of Some Enteric Bacteria in a Kraft Pulp Mill/Domestic Sewage Combined Treatment System,
W79-05420 5D

MALE, D. H.
Melting of a Prairie Snowpack,
W79-05252 2C

MALINS, D. C.
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

MANAHAN, S. E.
Wastewater Treatment with Humic Acid-Fly Ash Mixtures,
W79-05006 5D

MANCY, K. H.
The Effect of Preozonation on Chloroform Production in the Chlorine Disinfection Process,
W79-05480 5C

MAPLES, G.
Application of Phased Cooling to a Once-Through Cooling System,
W79-05227 5B

Rejection of Waste Heat from Power Plants Through Phased-Cooling,
W79-05228 5B

MARCUCELLA, H.
Behavioral Toxicology and Teleost Fish,
W79-05100 5C

MARIAN, M. B.
Solid State Control Systems for Irrigation,
W79-05289 3F

MARTIG, K. W. JR.
Flow Measurement,
W79-05388 4A

MARTIN, C.
Influence of Waste Residuals in Estuarine Waters on Development, Behavior and Survival of Soft-Shell Clam Larvae,
W79-05398 5C

MARTIN, C. D.
Washoff of Herbicides Applied to Corn Residue,
W79-05036 5B

MARTIN, S.
The Interaction of Oil with Sea Ice,
W79-05217 5C

MARZOLF, G. R.
Kansas River Limnology: Seasonal Variations in Photosynthetic Production and Heavy Metal Accumulation by Aquatic Insects,
W79-05234 5C

MASON, D. G.
Method and Apparatus for Separating Solids from Liquids,
W79-05381 5D

MASSEY, H. F.
Copper, Nickel, and Zinc Released from Acid Coal Mine Spoil Materials of Eastern Kentucky,
W79-05044 5A

MASSOTH, G. J.
Transport Mechanisms and Hydrocarbon Adsorption Properties of Suspended Matter in Lower Cook Inlet,
W79-05218 5C

MATLIN, R. W.
Solar Cell Irrigation,
W79-05308 3F

MAURER, D.
The Use of Species Abundance Estimates in Marine Benthic Studies,
W79-05109 5A

MAYAMA, H.
Ecological Observation on the Adult Salmon: I. Diurnal Variation of Upstream Migration of the Adult Chum Salmon in the Chitose River (In Japanese),
W79-05348 6G

MAYES, R. A.
Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

MCCABE, L. J.
The Epidemiologic Approach to the Evaluation of Organics in Drinking Water,
W79-05464 5C

MCCALEB, K. E.
Systems for Rapid Ranking of Environmental Pollutants. Selection of Subjects for Scientific and Technical Assessment Reports,
W79-05286 5A

MCCARTHY, M. F.
The Growth and Decay of a Hydraulic Jump,
W79-05146 8B

MCCLAIN, R. A.
Endogenous Bias in Technical Progress and Environmental Policy,
W79-05319 6B

MCCORKLE, M.
Flood-Plain Management in Dallas, Tex.: 1908-1978,
W79-05272 6F

MCDERMOTT, J. H.
Ground-Water Quality Standards--Relevant,
W79-05124 5B

MCDONALD, J.
Effluent Treatment at Prince George Pulp and Paper Ltd.,
W79-05419 5D

MCEUEN, J. M.
A Comparison of Bromine Chloride and Chlorine as Wastewater Disinfectants in Pilot Plant Studies,
W79-05485 5C

MCFARLAND, J. W.
Defining Upper Limits to Groundwater Development in the Arid West,
W79-05271 4B

MCINTOSH, A. W.
Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

MCKENZIE, S. W.
Analysis of Urban Storm-Water-Quality from Seven Basins Near Portland, Oregon,
W79-05156 5B

MCLEAY, D. J.
Influence of Dilution Water on the Toxicity of Kraft Pulp and Paper Mill Effluent, Including Mechanisms of Effect,
W79-05105 5A

MEAGHER, D.
Kennebec River Corridor Project -- Appendix III: Flow Regulation,
W79-05405 6B

Kennebec River Corridor Project -- Appendix IV: Flooding,
W79-05406 6B

Kennebec River Corridor Project -- Appendix V: Management Plan,
W79-05407 6B

MEHTA, Y. M.
Effect of Process Water Recycle on Pollution Control and Energy Conservation,
W79-05422 3E

MELISKY, E. L.
Modifications of Temperature Avoidance Troughs for Testing Small Fishes,
W79-05185 5A

MENZEL, R. G.
Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

MERCIER, E.
White Water Recycled at C.I.P. (Canadian International Paper Co.), Dalhousie, N.B.,
W79-05421 3E

MERRILL, S. D.
Laterally Confined Flow from a Point Source at the Surface of an Inhomogeneous Soil Column,
W79-05261 2G

MERRITT, R. G.
Digital Simulation of Snowmelt Runoff,
W79-05091 2E

METZNER, H. E.
A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

MEYER, F. P.
Announcement of Compounds Registered for Fishery Uses,
W79-05205 5A

MICHAELS, G. B.
Microbial Degradation of Dye Wastes in Aqueous Effluents,
W79-05048 5D

MIDDAUGH, D. P.
Seasonal Chronic Toxicity of Chlorination to the American Oyster, Crassotrea Virginica (G),
W79-05458 5C

MILLER, M. R.
Excavated Sediment Traps -- What Ralph Waldo Emerson was Really Talking About,
W79-05058 2J

MILLER, T. L.
Analysis of Urban Storm-Water-Quality from Seven Basins Near Portland, Oregon,
W79-05156 5B

MINEAR, R. A.
Evaluation of the Effects of Urbanization on Stormwater Runoff and Quality,
W79-05400 4C

MINOR, J.
A Program to Introduce Site-Specific Chlorination Regimes at Ontario Hydro Generating Stations,
W79-05442 5C

MISHOE, J. W.
Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

MOFFITT, L. J.
A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

MOLDENHAUER, W. C.
Size Distribution of Eroded Material from Simulated Rainfall: Effect Over a Range of Texture,
W79-05259 2J

MONNAT, J. Y.
Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

MOORE, D. D.
Automatic Liquid Flow Control Device,
W79-05375 3F

MOORE, G. K.
Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

MOREY, R. M.
Radar Anisotropy of Sea Ice Due to Preferred Azimuthal Orientation of the Horizontal C Axes of Ice Crystals,
W79-05138 2C

MORGAN, G. A.
Remote Sensing of the Oceans - A Review,
W79-05394 7B

MORGAN, K. M.
Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

MORITA, R. Y.
Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05220 5C

MORRELL, S. H.
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05221 5C

MORRIS, J. C.
Precursors and Mechanisms of Haloform Formation in the Chlorination of Water Supplies,
W79-05438 5A

MORROW, C. T.
A Simple Finite Element Method of Infiltration,
W79-05064 2G

MOSHER, D. C.
The Federal Ground-Water Protection Program--Tomorrow's Undoing,
W79-05129 5G

MOSHIRI, G. A.
Dissolved Glucose in a Bayou Estuary, Possible Sources and Utilization by Bacteria,
W79-05397 5C

MOSS, M. E.
Evaluation and Design of a Streamflow-Data Network in Washington,
W79-05159 7A

MOTTLEY, J.
The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

MOULTON, R. W.
Research and Development of Processes for Desalting Water by Freezing,
W79-05085 3A

MOURLON, J-C.
Control of Oil Pollution by Remote Sensing Along the Shores of France,
W79-05392 7B

MUIGA, M. I.
A Water Demand and Wastewater Disposal Model for Optimum Transfer of Water Resources Technology in Developing Countries,
W79-05413 6D

MUJDA, M. F.
A Simple Version of Gumbel's Method for Flood Estimation,
W79-05256 2E

MULDER, J.
Integrating Water Resources and Land Use Planning,
W79-05408 6B

MULLER, G.
Epidemic Problems and Chlorination of Drinking Water and Sewage in the Federal Republic of Germany,
W79-05471 5C

MULLER, J. W.
Fingerling American Shad: Effect of Valium, MS-222, and Sodium Chloride on Handling Mortality,
W79-05179 5B

MUNRO, J. R.
Influence of Dilution Water on the Toxicity of Kraft Pulp and Paper Mill Effluent, Including Mechanisms of Effect,
W79-05105 5A

MURABAYASHI, T.
Digital Simulation and Evaluation of Storm Drainage Systems: St. Louis Heights Watershed Model,
W79-05225 2A

MURAI, T.
Fingerling American Shad: Effect of Valium, MS-222, and Sodium Chloride on Handling Mortality,
W79-05179 5B

MURAKAMI, R.
Process for Phosphate Conversion Coating with Treatment of Rinse Water by Reverse Osmosis and Ion Exchange,
W79-05372 5D

MUSSELMAN, K. J.
Interactive Multiple Objective Optimization,
W79-05092 6A

MUTREJA, K. N.
Expected Asymptotic Maximum Deficit for Periodic-Stochastic Reservoir Inflows in Case of Partial Flow Regulation,
W79-05145 2H

Sizing of Reservoirs for Periodic-Stochastic Input and Periodic Output,
W79-05029 2H

MUZTAR, A. J.
The Chemical Composition of Aquatic Macrophytes. II. Amino Acid Composition of the Protein and Non-Protein in Fractions,
W79-05330 5C

MYHRE, D. L.
Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

NAGIEVA, E. E.
The Water State and Drought Resistance of Grapes in the Kopet-Dag Piedmont Subzone (In Russian),
W79-05342 2I

NAKAMURA, M.
Floating-Refuse-Collecting Boat,
W79-05380 5G

NAUGHTON, J. J.
Fume Compositions Found at Various Stages of Activity at Kilauea Volcano, Hawaii,
W79-05004 5A

Some Results from Recent Chemical Studies at Kilauea Volcano, Hawaii,
W79-05003 5A

NEBEKER, A. V.
Survival of Salmon Smolts in Sea Water After Exposure to Air-Supersaturated Water,
W79-05191 5B

NEITZEL, D. A.
Multiple Bottle Holder for In Situ Measurement of Primary Productivity,
W79-05201 5A

NELSON, D. W.
Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

Surface Runoff from Sludge-Amended Soils,
W79-05041 5B

NELSON, R. E.
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

NELSON, T. A.
Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

NEWBOLD, D. J.
Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forests Streams of Northern California,
W79-05005 5C

NG, S.
Mobile Bay Hydrography Under Flood Stage Conditions,
W79-05008 2L

NIEMI, I. I.
Ballasted Floating Barrier Boom,
W79-05376 5G

NIKITIN, YA V.
Highly Effective Paper-Machine Shower Systems (Vysoko-effektinye Spryskovye Sistemy),
W79-05430 3E

NIKONOVA, N. S.
Reaction of Soybeans to Overflooding of Soil, (In Russian),
W79-05284 2I

NOACK, M. G.
Reactions of Chlorine, Chlorine Dioxide and Mixtures Thereof with Humic Acid: An Interim Report,
W79-05439 5A

NOFZIGER, D. L.
Errors in Gamma-Ray Measurements of Water Content and Bulk Density in Nonuniform Soils,
W79-05251 2G

NOVAK, J. T.
Effect of Phosphorus Supply on Algal Biomass in a Turbid Missouri Reservoir,
W79-05001 5C

NOVICK, R.
Worldwide Aspects of Water Chlorination,
W79-05472 5C

O'CONNOR, T. P.
Bromine Chloride - An Alternative Biofouling Control Agent for Cooling Water Treatment,
W79-05493 5C

O'HARA, S. C. M.
On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

O'LEARY, P. M.
The Growth and Decay of a Hydraulic Jump,
W79-05146 8B

OCIEPA, A.
Comparative Studies on Methods for Determining Total Mercury in Fish. Dithizone and Flameless Atomic Absorption Spectrophotometry Techniques,
W79-05183 5B

OGURAN, H.
Floating-Refuse-Collecting Boat,
W79-05380 5G

OLLA, B. L.
Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

OLNESS, A. E.
Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

ONSTAD, C. A.
Characterization of Rill and Interrill Eroded Soil,
W79-05040 2J

ORIHUELA, L. A.
Worldwide Aspects of Water Chlorination,
W79-05472 5C

ORLOB, G. T.
Mathematical Modeling of Surface Water Impoundments, Volume: I, and II,
W79-05011 2H

ORR, M. H.
Acoustic Monitoring of Industrial Chemical Waste Release at Deep Water Dump Site 106,
W79-05264 5B

OSTERMEYER, J. S.
Energy and Irrigation,
W79-05288 3F

OTTO, L. E. JR.
Water Drive System for a Center Pivot Irrigation Unit or the Like,
W79-05387 3F

OVERTON, D. E.
Evaluation of the Effects of Urbanization on Stormwater Runoff and Quality,
W79-05400 4C

OYAIDE, S.
Floating-Refuse-Collecting Boat,
W79-05380 5G

OYLER, A. R.
Aqueous Chlorination Products of Polynuclear Aromatic Hydrocarbons,
W79-05440 5A

PAASIVIRTA, J.
Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

PAGE, T. L.
Multiple Bottle Holder for In Situ Measurement of Primary Productivity,
W79-05201 5A

PALL, R.
A Simple Finite Element Method of Infiltration,
W79-05064 2G

PALMER, C. M.
Algae and Water Pollution,
W79-05322 5C

PANDE, B. B. L.
A Simple Version of Gumbel's Method for Flood Estimation,
W79-05256 2E

PARSONS, B. L.
Excavated Sediment Traps -- What Ralph Waldo Emerson was Really Talking About,
W79-05058 2J

PATNI, N. K.
Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

PATTERSON, C.
The Role of Sprinkler Irrigation in Producing Specialty Crops,
W79-05296 3F

PATTI, F. J.
Parametric Cost Studies Pertaining to Dual-Purpose Power and Water Desalination Plants,
W79-05362 3A

PEARLMUTTER, N. L.
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

PEARSON, J. G.
Toxicity of Phossy Water to Selected Freshwater Organisms,
W79-05095 5B

PEDERSON, D. T.
Groundwater Levels in Nebraska, 1977,
W79-05150 2F

PENKAVA, F. F.
Center Pivots on Soils Marginally Suited for Irrigation in Manitoba, Canada,
W79-05291 3F

PENOT, M.
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

PETERSON, K. S.
Ballasted Floating Barrier Boom,
W79-05376 5G

PETRASEK, A. C.
Ultraviolet Disinfection of Municipal Effluents,
W79-05488 5D

PETRIE, B.
Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

PETTYJOHN, W. A.
Ground-Water Pollution--An Imminent Disaster,
W79-05121 5C

PEYTON, G. R.
Soluble Organic Constituents of Natural Waters and Wastewaters Before and After Chlorination,
W79-05436 5A

PFAENDER, F. K.
Natural and Model Aquatic Humics: Reactions with Chlorine,
W79-05437 5C

PFEIFFER, S.
Determination of Chloride in Sulfite Pulp Mill Effluents (Chloridbestimmung in Sulfitzellstoff-Ablaugen),
W79-05432 5A

PHAMWON, SANGUAN
Digital Simulation and Evaluation of Storm Drainage Systems: St. Louis Heights Watershed Model,
W79-05225 2A

PIERCE, R. S.
Effects of Sludge Applications on Soil Water Solution and Vegetation in a Northern Hardwood Stand,
W79-05002 5E

PIEST, R. F.
Sea Research Program for Channel Stability and Gully Control,
W79-05068 2J

PILLAI, C. R.
Effective Depth in Channels Having Bed Undulations,
W79-05254 2J

PIPER, B. S.
A Non-Linear Optimization Method for the Estimation of Aquifer Parameters,
W79-05026 2F

PITMAN, W. V.
Trends in Streamflow Due to Upstream Land-Use Changes,
W79-05147 2E

POLDERMAN, P. J. G.
Algae of Saltmarshes on the South and Southwest Coasts of England,
W79-05335 5C

POPE, R. L.
Nitrification with Rotating Biological Contactor Systems,
W79-05047 5D

POWER, W. H.
Thermodynamic Properties of Saline Water,
W79-05359 3A

PRICE, H.
Relationship Between Alluvial Soils and Flooding in the Piedmont Lowland of Southeastern Pennsylvania,
W79-05017 2E

PRITCHARD, R. S.
The Transport and Behavior of Oil Spilled in and Under Sea Ice,
W79-05224 5C

PROTASOWICKI, M.
Comparative Studies on Methods for Determining Total Mercury in Fish. Dithizone and Flameless Atomic Absorption Spectrophotometry Techniques,
W79-05183 5B

PROZUMENSHCHIKOVA, L. T.
Reaction of Soybeans to Overflooding of Soil, (In Russian),
W79-05284 2I

RAATS, P. A. C.
Laterally Confined Flow from a Point Source at the Surface of an Inhomogeneous Soil Column,
W79-05261 2G

RADEVA, V.
Effect of Transpiration Rate on the Uptake of Mineral Elements by Alfalfa Plants (In Bulgarian),
W79-05321 2I

RADZIUL, J. V.
Evaluation of the Capability of Granular Activated Carbon and Resins to Remove Chlorinated and Other Trace Organics from Treated Drinking Water,
W79-05478 5C

RADZIUN, K.
Effect of Phenol Upon Activation and Fertilization Ability of Rainbow Trout Spermatozoa (Salmo Gairdneri Rich.) (In Polish),
W79-05176 5C

RANDALL, C. W.
Chlorination and Water Treatment for Minimizing Trihalomethanes in Drinking Water,
W79-05474 5C

RANGO, A.
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

RAPSON, W. H.
Bleach Plant Operation,
W79-05497 3E

RASSADIN, A. YA.
Water Demand and Yield of Grain Crops in Cultivation Systems of Different Intensity, (In Russian),
W79-05336 2I

RAYNER, F. A.
Ground-Water Quality Standards--Irrelevant,
W79-05125 5B

RAZUMOVA, M. M.
Dynamic Changes in pH and Composition of Absorbed Cations in Irrigated Chernozems of the Trans-Volga Area (In Russian),
W79-05226 2K

REDDELL, D. L.
Predicting Dispersion Coefficients in Soils,
W79-05067 2G

REEVE, D. W.
Bleach Plant Operation,
W79-05497 3E

REID, G. W.
A Water Demand and Wastewater Disposal Model for Optimum Transfer of Water Resources Technology in Developing Countries,
W79-05413 6D

REVELANTE, N.
The Phytoplankton Characteristics of the Barrier Island Lagoons of the Gulf of California,
W79-05337 5C

RHOADES, E. D.
Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

RICE, S. D.
Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

RICHARD, P.
Extreme Temperature Tolerance of Palaemon Serratus (Pennant): Influence of Size and Acclimation) Tolerance Aux Temperatures Extremes

de Palaemon Serratus (Pennant): Influence de la Taille et de L'Acclimatation,
W79-05102 5C

RICHARDSON, C. W.
Influence of Row Spacing of Grain Sorghum on Ground Cover, Runoff, and Erosion,
W79-05258 3F

RICHARDSON, D. E.
Use of the Activated Sludge Process in the Treatment of Thermomechanical Pulping Effluents,
W79-05425 5D

RICHARDSON, E. V.
Mathematical Modeling of Sediment Deposition in Reservoirs,
W79-05142 2J

RICHARDSON, J. L.
Investigation of Thermal Diffusion for Saline Water Conversion,
W79-05361 3A

RICHARDSON, L. B.
Respiratory and Osmoregulatory Responses of White Perch (Morone Americana) Exposed to Chlorine and Ozone in Estuarine Waters,
W79-05461 5C

RICKABAUGH, J.
Trihalomethane Formation from Iodine and Chlorine Disinfection of Ohio River Water,
W79-05479 5C

RICKARD, M. A.
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

RIEDINGER, A.
Acid Mine Water Reverse Osmosis Test at Kittanning, Pennsylvania,
W79-05071 3A

RILEY, R.
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Continental Shelf,
W79-05222 5C

RILEY, R. G.
Investigation of Halogenated Components Formed From Chlorination of Marine Water,
W79-05452 5A

RILEY, T. L.
The Effect of Preozonation on Chloroform Production in the Chlorine Disinfection Process,
W79-05480 5C

RINCKE, G.
The German Federal Law on Wastewater Charges,
W79-05315 6E

RITTER, W. F.
Nonpoint Source Pollution from Coastal Plain Soils in Delaware,
W79-05065 5B

RIVERS, E. G.
Silt Barriers as Erosion Pollution Control in a Large Recreational Lake,
W79-05237 4D

ROBERTS, M. H. JR.
Effects of Chlorinated Sea Water on Decapod Crustaceans,
W79-05459 5C

ROBINSON, A. R.
Sea Research Program for Channel Stability and Gully Control,
W79-05068 2J

ROBINSON, P. F.
Toxicity of Phossy Water to Selected Freshwater Organisms,
W79-05095 5B

ROBINSON, S. C.
Measuring Efficiency of Surface Irrigation Systems,
W79-05307 3F

ROBY, K. B.
Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forests Streams of Northern California,
W79-05005 5C

ROCKWELL, A. L.
Aqueous Chlorination of Some Phenolic Acids,
W79-05441 5C

ROHATGI, P. K.
Solidification and Separation of Ice from Saline Water,
W79-05357 3A

ROMAIRE, R. P.
Predicting Nighttime Dissolved Oxygen Decline in Ponds Used for Tilapia Culture,
W79-05200 5B

ROSENBERG, N. W.
Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

ROSENZWEIG, M.
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

ROSS, E. H.
State Ground-Water Protection Programs--Adequate,
W79-05132 5G

ROSSMAN, L. A.
Distributing Regional Services Costs,
W79-05276 6C

ROVEY, C. K.
Land Application of Waste--State of the Art,
W79-05033 5E

ROVIG, L. R.
Integrating Water Resources and Land Use Planning,
W79-05408 6B

ROWLANDSON, G.
Bleach Plant Operation,
W79-05497 3E

RUBY, C. H.
Coastal Morphology, Oil Spill Vulnerability and Sedimentology of Kotzebue Sound and Kodiak Island,
W79-05213 5C

RUPAR, B.
Optimizing Traveling Sprinkler System Performance,
W79-05299 3F

RUSHTON, K. R.
Finite-Difference Solutions for One-Dimensional Dispersion Using an Improved Mesh Design,
W79-05028 2F

Radial Dispersion to an Abstraction Well,
W79-05027 2F

RUSSELL, S. O.
Estimating Design Flows for Urban Drainage,
W79-05024 2E

RUSSEO, A. R.
Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

RUSSO, R. C.
Toxicity of Copper to Cutthroat Trout (Salmo Clarki) Under Different Conditions of Alkalinity, pH, and Hardness,
W79-05107 5A

RYAN, P. W.
Investigation of Halogenated Components Formed From Chlorination of Marine Water,
W79-05452 5A

SALIBA, N. E.
Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

SAMET, C.
Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

SANDELL, D. J.
Development of a Direct-Freezing Continuous Wash-Separation Process for Saline Water Conversion,
W79-05364 3A

SARKKA, J.
Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

SARTORIS, J. J.
A Mathematical Model for Predicting River Temperatures--Application to the Green River below Flaming Gorge Dam,
W79-05283 2H

SAULNIER, G. J. JR.
Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado, 1975-76,
W79-05164 2F

SAUNDERS, F. M.
Nitrification with Rotating Biological Contactor Systems,
W79-05047 5D

SAY, P. J.
The Riou-Mort a Tributary to the River Lot Polluted by Heavy Metals. I. Preliminary Observations on the Chemistry and Benthic Algae,
W79-05206 5B

SAYRE, W. W.
Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

SCARPINO, P. V.
Chlorine Dioxide Destruction of Viruses and Bacteria in Water,
W79-05486 5C

SCHEIER, A.
A Bioassay Laboratory Boat with Comparisons of Central Vs. Boat Laboratory Bioassay Evaluations,
W79-05111 5A

SCHLESINGER, D. A.
Toward an Understanding of the Toxicity of Intermittent Exposures of Total Residual Chlorine to Freshwater Fishes,
W79-05444 5C

SCHLESINGER, D. A.

Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

SCHMIT, R. M.
Better Grasses for Roadsides,
W79-05238 6G

SCHNEIDER, M. J.
Predicting Effects of Cold Shock: Modeling the Decline of a Thermal Plume,
W79-05094 5B

SCHNEIDERMAN, M.
Risk Assessment of the Health Effects of Water Chlorination,
W79-05473 5C

SCHNICK, R. A.
Announcement of Compounds Registered for Fishery Uses,
W79-05205 5A

SCHULTZ, J.
Acid Mine Water Reverse Osmosis Test at Kittanning, Pennsylvania,
W79-05071 3A

SCOTT, A. P.
Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

SCOTT, G. I.
Seasonal Chronic Toxicity of Chlorination to the American Oyster, Crassotrea Virginica (G),
W79-05458 5C

SCOTT, J. M.
Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

SEEGERT, G. L.
A Preliminary Look at the Effects of Intermittent Chlorination on Selected Warmwater Fishes,
W79-05443 5C

SEELEY, H. W. JR.
Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

SERRA, J. L.
Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

SEVER, C. W.
The Federal Ground-Water Protection Program--Today's Hope,
W79-05128 5G

SHAFFER, P. T. B.
Chlorination and Water Treatment for Minimizing Trihalomethanes in Drinking Water,
W79-05474 5C

Development of Resistant Poliovirus by Repetitive Sublethal Exposure to Chlorine,
W79-05470 5C

SHAFLAND, P. L.
Self-Contained Upwelling System for Rearing Larval Fishes in the Laboratory,
W79-05182 5A

SHAPIRO, R. H.
Generation of Volatile Organic Compounds from Nonvolatile Precursors in Water by Treatment with Chlorine or Ozone,
W79-05482 5C

SHCHERBAKOV, B. I.
Growth Rhythms of Wheat Vegetative Organs and the Effect of Drought on Them (In Russian),
W79-05327 2I

SHEAFFER, J. R.
Land Application of Waste--Important Alternative,
W79-05032 5E

SHEARER, M. N.
Comparative Efficiency of Irrigation Systems,
W79-05303 3F

SHEATH, R. G.
Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

SHEFFIELD, L. F.
Economics of Irrigation,
W79-05292 3F

SHEPHARD, B. K.
Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

SHIH, S. F.
Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

SHTEFYRTSE, A. A.
Effects of Irrigation Methods on Water Exchange and Crop Capacity in Apple Tree (In Russian),
W79-05382 2I

SHULTZ, C. D.
Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

SIEKMEIER, D. A.
Water Drive System for a Center Pivot Irrigation Unit or the Like,
W79-05387 3F

SIEVERS, R. E.
Generation of Volatile Organic Compounds from Nonvolatile Precursors in Water by Treatment with Chlorine or Ozone,
W79-05482 5C

SIMMON, V. F.
The Mutagenic Activity of Halogenated Compounds Found in Chlorinated Drinking Water,
W79-05467 5C

SIMONETT, D. S.
Image Enhancement of Side-Scan Sonar Mapping,
W79-05395 7B

SINAI, G.
Modeling Nitrogen Movement in Agricultural Watersheds,
W79-05069 2G

SINDERMANN, C. J.
Pollution-Associated Diseases and Abnormalities of Fish and Shellfish: A Review,
W79-05097 5C

SINNING, J.
An Evaluation of the Status, Life History, and Habitat Requirements of the Endangered and Threatened Fishes of the Upper Colorado River System. Part Two,
W79-05114 5A

SKIPPEN, G. B.
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

SKRIPCHENKO, A. F.
Reaction of Soybeans to Overflooding of Soil, (In Russian),
W79-05284 2I

SLATEN, B. L.
Identification of Major Organic Constituents in Textile Waste Water Resulting from the Use of Sulfur Dyes,
W79-05230 5B

SLINGER, S. J.
The Chemical Composition of Aquatic Macrophytes. II. Amino Acid Composition of the Protein and Non-Protein in Fractions,
W79-05330 5C

SMAJSTRLA, A. G.
Predicting Dispersion Coefficients in Soils,
W79-05067 2G

SMITH, C. A.
Reactions in Chlorinated Seawater,
W79-05450 5A

SMITH, C. C.
Mutagenicity of Complex Mixtures from Drinking Water,
W79-05468 5C

SMITH, C. N.
Ionization Chamber for Water Treatment System,
W79-05384 5F

SMITH, G. A.
Soil Erosion and Sediment Movement Under Sugarcane Culture on the Flat Lands of Southern Louisiana,
W79-05038 2J

SMITH, J. H.
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

SMITH, J. O.
The Law of Surface Water Allocation in Georgia,
W79-05415 6E

SMITH, J. P.
Reducing Stream Sediment Loads by Irrigation Diversions,
W79-05057 2J

Sediment Characteristics and Transport from Northwest Rangeland Watersheds,
W79-05035 2J

SMITH, M. L. JR.
A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

SMITH, P. J.
A Non-Linear Optimization Method for the Estimation of Aquifer Parameters,
W79-05026 2F

SMITH, R. W.
An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

SMITH, S. J.
Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

SNEED, R. E.
The Use of Overtree Irrigation for Crop Cooling and Frost and Freeze Protection on Apples,
W79-05298 3F

SNIDER, I. W. A.
Primary Effluent Treatment at Domtar (Fine Papers Ltd.) Cornwall Mill,
W79-05418 5D

SOLOMON, K.
Evaluation Criteria for Trickle Irrigation Emission Devices,
W79-05309 3F

Simulated Flow Rate Requirements for Some Flushing Emitters,
W79-05062 8B

SOMLYODY, L.
Mixing Model for Large Streams,
W79-05133 5B

SONNEBORN, M.
Formation and Occurrence of Haloforms in Drinking Water in the Federal Republic of Germany,
W79-05475 5C

SOREY, M. L.
Numerical Modeling of Liquid Geothermal Systems,
W79-05173 1A

SPOONER, M. F.
Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

Editorial Introduction,
W79-05188 5A

STAFFORD, P. M.
Investigation of the Availability of Geothermal Energy for the Demineralization of Saline Water,
W79-05367 3A

STAKER, R. D.
An Annual Phytoplankton Study in Coastal Waters Off Eastern Long Island (Block Island Sound),
W79-05231 5C

STAMER, J. K.
Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

STAUFFER, J. R.
Modifications of Temperature Avoidance Troughs for Testing Small Fishes,
W79-05185 5A

STEELE, T. D.
Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

STENSAAS, E. R.
Investigation of the Availability of Geothermal Energy for the Demineralization of Saline Water,
W79-05367 3A

STEPHENS, J. A.
Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

STEVENS, D. G.
Survival of Salmon Smolts in Sea Water After Exposure to Air-Supersaturated Water,
W79-05191 5B

STEVENS, R. G.
Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

STOFFERS, P.
Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

STONE, L.
Parametric Cost Studies Pertaining to Dual-Purpose Power and Water Desalination Plants,
W79-05362 3A

STOREY, D. A.
An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

STOUT, V. F.
Analysis of Chlorinated Hydrocarbon Pollutants: A Simplified Extraction and Cleanup Procedure for Fishery Products,
W79-05110 5A

STOWE, T. J.
Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

STRACK, O. D. L.
Distributed Sources for Unconfined Groundwater Flow in a Half-Space,
W79-05025 2F

STRAIN, P. J.
Polluting Oil Recovery Apparatus,
W79-05390 5G

SUFFET, I. H.
Evaluation of the Capability of Granular Activated Carbon and Resins to Remove Chlorinated and Other Trace Organics from Treated Drinking Water,
W79-05478 5C

SUGAM, R.
Chlorine Degradation and Halocarbon Production in Estuarine Waters,
W79-05451 5A

SULLIVAN, M. J.
Diatom Community Structure: Taxonomic and Statistical Analyses of a Mississippi Salt Marsh,
W79-05007 5C

SUMMERHAYES, C. P.
Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

SUNNELL, G. J.
Estimating Design Flows for Urban Drainage,
W79-05024 2E

SUSSER, M.
A Case Control Study of Gastrointestinal and Urinary Tract Cancer Mortality and Drinking Water Chlorination,
W79-05465 5C

SUTHERLAND, S. M.
Development of Resistant Poliovirus by Repetitive Sublethal Exposure to Chlorine,
W79-05470 5C

SVOBODOVA, Z.
Histopathological Changes in the Fish After Intoxication with Non-Ionogenic Tensides on the Basis of Ethoxyl Aducts of Isononylphenols (Histopatologicke Zmeny u Ryb Po Intoxikaci Neionogennimi Tenzidy na Bazi Ethoxylovych Aduktu Isononylfenolu),
W79-05099 5C

SWAN, G. A.
Dip Basket for Collecting Juvenile Salmon and Trout in Gatewells at Hydroelectric Dams,
W79-05175 5A

SWIFT, D. J. P.
Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

SYMONS, J. M.
Ozone, Chlorine Dioxide and Chloramines as Alternatives to Chlorine for Disinfection of Drinking Water,
W79-05477 5C

TAKAHASHI, T.
Ecological Observation on the Adult Salmon: I. Diurnal Variation of Upstream Migration of the Adult Chum Salmon in the Chitose River (In Japanese),
W79-05348 6G

TALAVAGE, J. J.
Interactive Multiple Objective Optimization,
W79-05092 6A

TAMAS, G.
The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

TAN, G. D.
Computer Simulation of Bubbler-Induced Melting of Ice Covers Using Experimental Heat Transfer Results,
W79-05279 2C

TANKIN, R. S.
Computer Simulation of Bubbler-Induced Melting of Ice Covers Using Experimental Heat Transfer Results,
W79-05279 2C

TARDIFF, R. G.
The Mutagenic Activity of Halogenated Compounds Found in Chlorinated Drinking Water,
W79-05467 5C

TARVER, G. R.
Summary Appraisals of the Nation's Ground-Water Resources--South Atlantic-Gulf Region,
W79-05154 2F

TAYLOR, J. A.
The Influence of Turbidity on Net Phytoplankton Photosynthesis in Some Irish Lakes,
W79-05098 5C

TAYLOR, O. J.
Summary Appraisals of the Nation's Ground-Water Resources--Missouri Basin Region,
W79-05152 7C

TAYLOR, R. B.
Bromine Chloride as an Alternative Wastewater Disinfectant to Chlorine,
W79-05484 5C

TEN HOOPEN, A.
The Short Day Response in Acrosymphyton Purpuriferum (J. Ag.) Sjost. (Rhodophyceae, Crytonemiales),
W79-05325 5C

TEN HOOPEN, H. J. G.
A Mercury Buffer for Toxicity Experiments with Green Algae,
W79-05210 5A

TEPPEN, T. C.
Avoidance of Monochloramine: Test Tank Results for Rainbow Trout, Coho Salmon, Alewife, Yellow Perch and Spottail Shiner,
W79-05447 5C

THATCHER, T. O.
The Relative Sensitivity of Pacific Northwest Fishes and Invertebrates to Chlorinated Sea Water,
W79-05460 5C

THOMAS, D.
Fume Compositions Found at Various Stages of Activity at Kilauea Volcano, Hawaii,
W79-05004 5A

THOMAS, R. E.
Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

THURLEY, D. S.
Use of the Activated Sludge Process in the Treatment of Thermomechanical Pulping Effluents,
W79-05425 5D

THURSTON, R. V.
Toxicity of Copper to Cutthroat Trout (Salmo Clarki) Under Different Conditions of Alkalinity, pH, and Hardness,
W79-05107 5A

TIRRELL, C. E.
Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

TOMASIK, L.
Effect of Phenol Upon Activation and Fertilization Ability of Rainbow Trout Spermatozoa (Salmo Gairdneri Rich.) (In Polish),
W79-05176 5C

TOOLE, J. M.
The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

TORNO, H. C.
Stormwater Management Model: Transfer of Technology,
W79-05412 5B

TOTTEN, P. L.
Method of Clarifying and Removing Water from Water-Solids Suspensions,
W79-05383 5D

TOURENO, J. N.
Changes in the Species Composition of Fish in the River Lot,
W79-05184 5B

TRABALKA, J. R.
Investigation of the Effects of Halogenated Organic Compounds Produced in Cooling Systems and Process Effluents on Aquatic Organisms,
W79-05448 5C

TRENT, D. S.
Predicting Effects of Cold Shock: Modeling the Decline of a Thermal Plume,
W79-05094 5B

TRIBE, G.
Irrigation Efficiency in Scheduling,
W79-05304 3F

TRIHEY, E. F.
Interacting Effects of Minimum Flow and Fluctuating Shorelines on Benthic Stream Insects,
W79-05233 2E

TROXLER, W. L.
Evaluation of the Effects of Urbanization on Stormwater Runoff and Quality,
W79-05400 4C

TRUITT, R. E.
Fate of Metal Ions During Domestic Treatment of Water Containing Organics,
W79-05046 5F

TRUSSELL, A. R.
Optimizing Trihalomethane Analysis,
W79-05476 5A

TRUSSELL, R. R.
Optimizing Trihalomethane Analysis,
W79-05476 5A

TRYON, C. P.
Excavated Sediment Traps -- What Ralph Waldo Emerson was Really Talking About,
W79-05058 2J

TSAI, KUO-CHUN
New Design Criteria for the Aerobic Digestion of Sewage Lime Sludge,
W79-05009 5D

ULANSKI, S. L.
Some Aspects of Florida Convective Rainfall,
W79-05139 2B

UMPHRES, M. D.
Optimizing Trihalomethane Analysis,
W79-05476 5A

UNRATH, C. R.
The Use of Overtree Irrigation for Crop Cooling and Frost and Freeze Protection on Apples,
W79-05298 3F

VACHER, H. L.
Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

VADAS, R. L.
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

VAN DER HEEM, P.
The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-05368 3A

VANDERPOST, J. M.
The Growth Patterns of Some Enteric Bacteria in a Kraft Pulp Mill/Domestic Sewage Combined Treatment System,
W79-05420 5D

VAROGLU, E.
A Finite Element Method for the Diffusion-Convection Equation with Constant Coefficients,
W79-05019 5B

VEITH, G. D.
Brominated Compounds Found in Waste-Treatment Effluents and Their Capacity to Bioaccumulate,
W79-05449 5C

VENOSA, A. D.
A Study of Alternatives to Chlorination for Disinfection of Wastewater,
W79-05483 5C

Ultraviolet Disinfection of Municipal Effluents,
W79-05488 5D

VIDAVER, W.
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

VIDEAU, C.
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

VITOSH, M. L.
Scheduling of Water and Nitrogen for Corn in the Humid Midwest,
W79-05295 3F

VLACHOS, E.
A Conceptual Model of the Knowledge Transfer Process,
W79-05410 10D

WAITE, T. D.
Evaluation of Alternative Chemical Treatments for Biofouling Control in Electric Power Facilities,
W79-05494 5C

WALDEN, C. C.
Influence of Dilution Water on the Toxicity of Kraft Pulp and Paper Mill Effluent, Including Mechanisms of Effect,
W79-05105 5A

WALKER, R. G.
Fluvial Processes and Facies Sequences in the Sandy Braided South Saskatchewan River, Canada,
W79-05135 2J

WALLACE, C. J.
Chlorine and Activated Carbon Treatment for Removal of Toxic Substances From Water,
W79-05487 5C

WALLACE, R. L.
Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

WALLENTINUS, I.
Productivity Studies on Baltic Macroalgae,
W79-05347 5C

WARD, R. W.
A Study of Alternatives to Chlorination for Disinfection of Wastewater,
W79-05483 5C

WARNER, J. S.
Activity-Directed Fractionation of Petroleum Samples,
W79-05223 5C

WARREN, C. E.
Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

WATLING, L.
The Use of Species Abundance Estimates in Marine Benthic Studies,
W79-05109 5A

WATSON, J. L.
Method of Clarifying and Removing Water from Water-Solids Suspensions,
W79-05383 5D

WATTERS, G. Z.
Trickle Irrigation Tubing Hydraulics,
W79-05061 8B

WEARE, T. J.
Modeling Two-Dimensional Circulating Flow,
W79-05255 8B

WEAVER, J. C.
Method and Apparatus for Separating Solids from Liquids,
W79-05381 5D

WEBER, D. D.
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

WEBER, J. H.
Fate of Metal Ions During Domestic Treatment of Water Containing Organics,
W79-05046 5F

WELCH, K. J.
Aqueous Chlorination Products of Polynuclear Aromatic Hydrocarbons,
W79-05440 5A

WELDER, F. A.
Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado, 1975-76,
W79-05164 2F

WHITE, E. H.
Microbial Degradation of Dye Wastes in Aqueous Effluents,
W79-05048 5D

WHITE, J.
Remote Sensing for Oil Pollution Control Along Coastal Waters of the United States,
W79-05393 7B

WHITE, T.
Heavy Metal Concentrations at the Apex of the New York Bight,
W79-05117 5A

WHITEHOUSE, J. W.
Continuous Low-Level Chlorination for Marine Fouling Control at Power Stations in the United Kingdom,
W79-05462 5C

WILDING, D. A.
Trihalomethane Reduction at the Louisville Water Company,
W79-05481 5C

WILLIS, W. W.
A Model Study of St. Marys River Ice Navigation,
W79-05278 2C

WISSMAN, R. C.
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

WITHERS, N.
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

WITSCHI, W. A.
Evaluation of pH Shock on Hatchery-Reared Rainbow Trout,
W79-05202 5C

WITTENBERG, L. A.
Storm-Water Data for Bear Creek Basin, Jackson County, Oregon, 1977-78,
W79-05171 5B

WODZINSKI, R. S.
Effect of Sulfur Dioxide on Algae,
W79-05352 5C

WOLF, E. G.
Multiple Bottle Holder for In Situ Measurement of Primary Productivity,
W79-05201 5A

WOLF, H. W.
Ultraviolet Disinfection of Municipal Effluents,
W79-05488 5D

WOLFE, D. A.
The Amoco Cadiz Oil Spill. A Summary of Observations Made By U.S. Scientists 23 March-10 May, 1978,
W79-05195 5C

WONG, G. T. F.
Biological and Chemical Effects of Chlorination at Coastal Power Plants,
W79-05456 5C

WOODFIN, W. L. JR.
Bromine Chloride as an Alternative Wastewater Disinfectant to Chlorine,
W79-05484 5C

WRIGHT, K. R.
Land Application of Waste--State of the Art,
W79-05033 5E

WRIGHT, R. T.
Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

YANG, W. H.
Internal Waves in a Circular Channel,
W79-05250 2H

YEH, H. J.
Transient Subsurface Drainage on Sloping Irrigated Land,
W79-05052 6A

YEVJEVICH, V.
Expected Asymptotic Maximum Deficit for Periodic-Stochastic Reservoir Inflows in Case of Partial Flow Regulation,
W79-05145 2H

Sizing of Reservoirs for Periodic-Stochastic Input and Periodic Output,
W79-05029 2H

YIH, C-S.
Comparison Theorems for Gravity Waves in Basins of Variable Depth,
W79-05253 2H

Internal Waves in a Circular Channel,
W79-05250 2H

YOUNG, D. R.
DDT, PCB and Chlorinated Benzenes in the Marine Ecosystem Off Southern California,
W79-05455 5C

Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

YOUNG, R. A.
Characterization of Rill and Interrill Eroded Soil,
W79-05040 2J

Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

YU-SI FOK, E.
Digital Simulation and Evaluation of Storm Drainage Systems: St. Louis Heights Watershed Model,
W79-05225 2A

ZAAL, J. F. J.
The Growth Patterns of Some Enteric Bacteria in a Kraft Pulp Mill/Domestic Sewage Combined Treatment System,
W79-05420 5D

ZECHER, D. C.
Process for Inhibiting Corrosion of Metals in Aqueous Systems,
W79-05391 5F

ZENK, W.
The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

ZENONE, C.
Summary Appraisals of the Nation's Ground-Water Resources--Alaska,
W79-05153 2F

ZIEBELL, C. D.
Evaluation of pH Shock on Hatchery-Reared Rainbow Trout,
W79-05202 5C

ZILBERMAN, D.
A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

ZINK, M. L.
Chlorine Dioxide Destruction of Viruses and Bacteria in Water,
W79-05486 5C

ZINNOUTI, M.
Process for Phosphate Conversion Coating with Treatment of Rinse Water by Reverse Osmosis and Ion Exchange,
W79-05372 5D

ZIZZA, M.
Parametric Cost Studies Pertaining to Dual-Purpose Power and Water Desalination Plants,
W79-05362 3A

ZOGORSKI, J. S.
Trihalomethane Reduction at the Louisville Water Company,
W79-05481 5C

ORGANIZATIONAL INDEX

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, AVONDALE, PA. STROUD WATER RESEARCH CENTER.
Aqueous Chlorination of Some Phenolic Acids,
W79-05441 5C

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, BENEDICT, MD. BENEDICT ESTUARINE RESEARCH LAB.
Biofouling Control Alternatives to Chlorine for Power Plant Cooling Water Systems: An Overview,
W79-05492 5C

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, PA. DIV. OF LIMNOLOGY AND ECOLOGY.
A Bioassay Laboratory Boat with Comparisons of Central Vs. Boat Laboratory Bioassay Evaluations,
W79-05111 5A

ACRES INTERNATIONAL LTD., NIAGARA FALLS (ONTARIO).
A Model Study of St. Marys River Ice Navigation,
W79-05278 2C

AGRICULTURAL RESEARCH AND EDUCATION CENTER, BELLE GLADE, FL.
Modeling the Subsidence of Everglades Organic Soil,
W79-05037 2G

AGRICULTURAL RESEARCH AND EDUCATION CENTER, LAKE ALFRED, FL.
Bacterial Clogging in Low Pressure Irrigation Systems,
W79-05312 3F

AGRICULTURAL RESEARCH SERVICE, DURANT, OK. WATER QUALITY MANAGEMENT LAB.
Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland,
W79-05429 5C

AIRCRAFT RESEARCH AND DEVELOPMENT UNIT, EDINBURGH (AUSTRALIA).
Remote Sensing of the Oceans - A Review,
W79-05394 7B

AIRESEARCH MFG. CO. OF ARIZONA, PHOENIX.
Heat Transfer and Corrosion Characteristics of Capillary Fluted Aluminum Tubes,
W79-05360 3A

AKADEMIYA NAUK KAZAKHSKOI SSR, ALMA-ATA. INST. BOTANIKI.
Growth Rhythms of Wheat Vegetative Organs and the Effect of Drought on Them (In Russian),
W79-05327 2I

AKADEMIYA NAUK MOLDAVSKOI SSR, KISHINEV. INST. OF PLANT PHYSIOLOGY AND BIOCHEMISTRY.
Effects of Irrigation Methods on Water Exchange and Crop Capacity in Apple Tree (In Russian),
W79-05382 2I

AKADEMIYA NAUK URSR, KIEV. PLANT PHYSIOLOGY INST.
Intracellular Oxygen and Radiosensitization of the Blue-Green Algae,
W79-05333 5C

ALABAMA UNIV., AUBURN. DEPT. OF FISHERIES AND ALLIED AQUACULTURES.
Predicting Nighttime Dissolved Oxygen Decline in Ponds Used for Tilapia Culture,
W79-05200 5B

ALABAMA UNIV., UNIVERSITY. DEPT. OF CHEMICAL AND METALLURGICAL ENGINEERING.
Mobile Bay Hydrography Under Flood Stage Conditions,
W79-05008 2L

ALASKA UNIV., FAIRBANKS. INST. OF MARINE SCIENCE.
Distribution and Dynamics of Heavy Metals in Alaskan Shelf Environments Subject to Oil Development,
W79-05219 5C

ALBERTA UNIV., EDMONTON. DEPT. OF BOTANY.
Phytoplankton Primary Productivity and Population Efficiency Studies in a Prairie-Parkland Lake Near Edmonton, Alberta, Canada,
W79-05351 5C

AMERICAN HYDROTHERM CORP., NY.
Brackish Water Conversion Demonstration Plant No. 4, Rosewell, New Mexico: Third Annual Report.
W79-05070 3A

AMIENS UNIV. (FRANCE). LAB. DE PHYSIOLOGIE.
Methods for Determining the Oxygen Consumption of a Fish Under Conditions of Aquatic Semi-Confinement (Methodes de Determination de la Consommation D'Oxygene D'un Poisson Dans Les Conditions Du Semi-Confinement Aquatique),
W79-05112 5A

ARIZONA COOPERATIVE FISHERY UNIT, TUCSON.
Evaluation of pH Shock on Hatchery-Reared Rainbow Trout,
W79-05202 5C

ARIZONA UNIV., TUCSON. DEPT. OF SYSTEMS AND INDUSTRIAL ENGINEERING AND ARIZONA UNIV., TUCSON. DEPT. OF HYDROLOGY AND WATER RESOURCES.
An Event-Based Stochastic Model of Phosphorus Loading into a Lake,
W79-05021 5B

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, ABERDEEN PROVING GROUND, MD. CHEMICAL SYSTEMS LAB.
Toxicity of Phossy Water to Selected Freshwater Organisms,
W79-05095 5B

ARMY TERRESTRIAL SCIENCES CENTER, HANOVER, NH. EARTH SCIENCES BRANCH.
Radar Anisotropy of Sea Ice Due to Preferred Azimuthal Orientation of the Horizontal C Axes of Ice Crystals,
W79-05138 2C

AUBURN UNIV., AL. COOPERATIVE EXTENSION SERVICE.
Factors Influencing System Selection in Humid Regions,
W79-05297 3F

AUBURN UNIV., AL. DEPT. OF CONSUMER AFFAIRS.
Identification of Major Organic Constituents in Textile Waste Water Resulting from the Use of Sulfur Dyes,
W79-05230 5B

AUBURN UNIV., AL. DEPT. OF MECHANICAL ENGINEERING.
Application of Phased Cooling to a Once-Through Cooling System,
W79-05227 5B

Rejection of Waste Heat from Power Plants Through Phased-Cooling,
W79-05228 5B

AUSTRALIAN NEWSPRINT MILLS LTD.
Use of the Activated Sludge Process in the Treatment of Thermomechanical Pulping Effluents,
W79-05425 5D

BALDWIN-LIMA-HAMILTON CORP., PHILADELPHIA, PA. INDUSTRIAL EQUIPMENT DIV.
Research on and Analysis of Single-Effect Low Temperature Flash Evaporation Process.
W79-05080 3A

BATELLE PACIFIC NORTHWEST LAB., RICHLAND, WA.
Investigation of Halogenated Components Formed From Chlorination of Marine Water,
W79-05452 5A

BATTELLE COLUMBUS LABS., OH.
Activity-Directed Fractionation of Petroleum Samples,
W79-05223 5C

A Solar-Powered Pump for Irrigation,
W79-05287 3F

BATTELLE PACIFIC NORTHWEST LAB., RICHLAND, WA.
Multiple Bottle Holder for In Situ Measurement of Primary Productivity,
W79-05201 5A

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WA. ECOSYSTEMS DEPT.
Predicting Effects of Cold Shock: Modeling the Decline of a Thermal Plume,
W79-05094 5B

BATTELLE PACIFIC NORTHWEST LABS., SEQUIM, WA. MARINE RESEARCH LAB.
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Continental Shelf,
W79-05222 5C

BATTELLE PACIFIC NORTHWEST LABS. SEQUIM, WA. MARINE RESEARCH LABS.
The Relative Sensitivity of Pacific Northwest Fishes and Invertebrates to Chlorinated Sea Water,
W79-05460 5C

BECHTEL, INC., SAN FRANCISCO, CA.
Transient Subsurface Drainage on Sloping Irrigated Land,
W79-05052 6A

BEDFORD INST. OF OCEANOGRAPHY, DARTMOUTH (NOVA SCOTIA). DEPT. OF FISHERIES AND THE ENVIRONMENT.
Numerical Model of the Circulation in an Open Bay,
W79-05134 2L

BENNETT AND BENNETT IRRIGATION PIPE CO., HANFORD, CA.
Measuring Efficiency of Surface Irrigation Systems,
W79-05307 3F

BERGEN UNIV. (NORWAY). INST. OF MARINE BIOLOGY.
Phytoplankton Production at Two Statins in Linda-Spollene, a Norwegian Land-Locked Fjord, and Limiting Nutrients Studied by Two Kinds of Bio-Assays,
W79-05350 5C

BETZ LAB., INC., TREVOSE, PA.
Boiler Water Treatment: Is the Paper Industry A Special Case,
W79-05499 5F

BILBAO UNIV. (SPAIN). DEPT. OF BIOCHEMISTRY.
Characterization of the Nitrate Reductase Activity in the Diatom Skeletonema Costatum,
W79-05332 5C

BIRMINGHAM UNI. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Finite-Difference Solutions for One-Dimensional Dispersion Using an Improved Mesh Design,
W79-05028 2F

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Radial Dispersion to an Abstraction Well,
W79-05027 2F

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF GEOLOGICAL SCIENCES.
An Example of the Use of Factor Analysis and Cluster Analysis in Groundwater Chemistry Interpretation,
W79-05143 2F

BJORKSTEN RESEARCH LAB., INC., MADISON, WI.
Weathering Tests of Plastics and Design of Suspended Envelope Solar Stills,
W79-05371 3A

BLACK AND VEATCH, KANSAS CITY, MO.
Results of a Preliminary Survey of Candidate Communities for Saline Water Demineralization Applications.
W79-05077 3A

BREEDLOVE ASSOCIATES, INC., GAINESVILLE, FL.
Concentrations of Selected Elements and Ash in Bluegill (Lepomis Macrochirus) and Certain other Freshwater Fish,
W79-05208 5A

BRITISH COLUMBIA RESEARCH COUNCIL, VANCOUVER. DIV. OF APPLIED BIOLOGY.
Influence of Dilution Water on the Toxicity of Kraft Pulp and Paper Mill Effluent, Including Mechanisms of Effect,
W79-05105 5A

BRITISH COLUMBIA UNIV., VANCOUVER. FACULTY OF GRADUATE STUDIES.
A Finite Element Method for the Diffusion-Convection Equation with Constant Coefficients,
W79-05019 5B

BRITISH COLUMBIA, VANCOUVER. DEPT. OF CIVIL ENGINEERING.
Estimating Design Flows for Urban Drainage,
W79-05024 2E

BRITISH PETROLEUM CO. LTD., LONDON (ENGLAND). (ASSIGNEE).
Oil Separation Material,
W79-05378 5G

BUNDESGESUNDHEITSAMT, BERLIN (GERMANY, F.R.). INST. FUER WASSER-, BODEN-, UND LUFTHYGIENE.
Epidemic Problems and Chlorination of Drinking Water and Sewage in the Federal Republic of Germany,
W79-05471 5C

Formation and Occurrence of Haloforms in Drinking Water in the Federal Republic of Germany,
W79-05475 5C

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS, CANBERRA (AUSTRALIA). PETROLEUM EXPLORATION BRANCH.
The Nature of Metals-Sediment-Water Interactions in Freshwater Bodies, with Emphasis on the Role of Organic Matter,
W79-05106 5A

BUREAU OF RECLAMATION, DENVER, CO.
Test Manual (Tentative) for Permselective Membranes.
W79-05086 3A

BUREAU OF RECLAMATION, DENVER, CO. ENGINEERING AND RESEARCH CENTER.
A Mathematical Model for Predicting River Temperatures--Application to the Green River below Flaming Gorge Dam,
W79-05283 2H

BUREAU OF SPORT FISHERIES AND WILDLIFE, CORTLAND, NY. TUNISON LAB. OF FISH NUTRITION.
Atlantic Salmon Embryos and Fry: Effects of Various Incubation and Rearing Methods on Hatchery Survival and Growth,
W79-05187 5C

BURNS AND ROE, INC., NEW YORK.
Parametric Cost Studies Pertaining to Dual-Purpose Power and Water Desalination Plants,
W79-05362 3A

CALIFORNIA UNIV., BERKELEY.
A 'Putty-Clay' Approach to Aggregation of Production/Pollution Possibilities: An Application in Dairy Waste Control,
W79-05318 6B

CALIFORNIA UNIV., BERKELEY. DEPT. OF FORESTRY AND CONSERVATION.
Biological Assessment of Timber Management Activity Impacts and Buffer Strip Effectiveness on National Forests Streams of Northern California,
W79-05005 5C

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
A Priori Predictive Methods of Assessing Health Effects of Chemicals in the Environment,
W79-05469 5C

CALIFORNIA UNIV., DAVIS. DEPT. OF LAND, AIR AND WATER RESOURCES.
Societal Attitudes and Resultant Policies Call for Water Conservation,
W79-05301 3F

CALIFORNIA UNIV., PARLIER. COOPERATIVE EXTENSION.
Introduction to Irrigation Efficiency and Scheduling,
W79-05300 3F

Water Efficiency with Deficit and Suboptimal Irrigation,
W79-05302 3F

CALIFORNIA UNIV., SAN DIEGO, LA JOLLA. INST. OF MARINE RESOURCES.
Population Dynamics and Production of a Planktonic Marine Copepod, Acartia Clausii, in a Small Temperate Lagoon on San Juan Island, Washington,
W79-05346 5C

CALIFORNIA UNIV., SANTA BARBARA.
Image Enhancement of Side-Scan Sonar Mapping,
W79-05395 7B

CAMBRIDGE UNIV. (ENGLAND). CONTROL AND MANAGEMENT SYSTEMS DIV.
Mathematical Modeling of Water Quality,
W79-05273 6A

CATALYTIC CONSTRUCTION CO., PHILADELPHIA, PA.
A Study of Desalting Plants (15 to 150 MGD) and Nuclear Power Plants (200 to 1500 MWt) for Combined Water and Power Production.
W79-05075 3A

CENTRAL ELECTRICITY GENERATING BOARD, LEATHERHEAD (ENGLAND). CENTRAL ELECTRICITY RESEARCH LABS.
Continuous Low-Level Chlorination for Marine Fouling Control at Power Stations in the United Kingdom,
W79-05462 5C

CENTRAL ELECTRICITY GENERATING BOARD, SOUTHAMPTON (ENGLAND). MARINE BIOLOGICAL LAB.; AND CENTRAL ELECTRICITY GENERATING BOARD, FAWLEY (ENGLAND). FAWLEY POWER STATION.
Response of Entrained Plankton to Low-Level Chlorination at a Coastal Power Station,
W79-05463 5C

CENTRE OCEANOLOGIQUE DE BRETAGNE BREST (FRANCE).
The Amoco Cadiz Oil Spill-Lines of Study and Early Observations,
W79-05189 5A

CHANCE VOUGHT CORP., DALLAS, TX.
Utilization of Isotopes for Saline Water Conversion.
W79-05084 3A

CHEMICAL SYSTEMS INC., TUSTIN, CA.
Development of DRY-RO Membranes from Sulfonated Cellulose Acetates and Quaternized Cellulose Acetate Carbamates,
W79-05045 3A

CINCINNATI UNIV., OH. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Chlorine Dioxide Destruction of Viruses and Bacteria in Water,
W79-05486 5C

CINCINNATI UNIV., OH. DEPT. OF CIVL AND ENVIRONMENTAL ENGINEERING.
Trihalomethane Formation from Iodine and Chlorine Disinfection of Ohio River Water,
W79-05479 5C

CINCINNATI UNIV., OH. DEPT. OF MICROBIOLOGY.
Mutagenicity of Complex Mixtures from Drinking Water,
W79-05468 5C

CINCINNATI UNIV., OH. SOUTHWESTERN OHIO REGIONAL COMPUTER CENTER.
Users Manual: Data Storage and Retrieval System for Pilot Wastewater Treatment Research,
W79-05281 7C

COAST GUARD RESEARCH AND DEVELOPMENT CENTER, GROTON, CT.
Remote Sensing for Oil Pollution Control Along Coastal Waters of the United States,
W79-05393 7B

COLOGNE UNIV. (GERMANY, F.R.). BOTANISCHES INST.
Patterns of Photoassimilatory Products in Pacific Rhodophyceae,
W79-05328 5C

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Flow Resistance of Large-Scale Roughness,
W79-05141 2E

Mathematical Modeling of Sediment Deposition in Reservoirs,
W79-05142 2J

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF ECONOMICS.
A Multidisciplinary Transfer Model for Water Management Knowledge Transfer in Developing Countries,
W79-05411 6A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF SOCIOLOGY.
A Conceptual Model of the Knowledge Transfer Process,
W79-05410 10D

COLORADO STATE UNIVERSITY, FORT COLLINS, CO. DEPT. OF POLITICAL SCIENCE.
Institutional Arrangements for Effective Water Management in Colorado,
W79-05049 6E

COLORADO UNIV., BOULDER. DEPT. OF CHEMISTRY.
Generation of Volatile Organic Compounds from Nonvolatile Precursors in Water by Treatment with Chlorine or Ozone,
W79-05482 5C

CONSOLIDATED-BATHURST LTD., MONTREAL (QUEBEC).
Effect of Process Water Recycle on Pollution Control and Energy Conservation,
W79-05422 3E

CONSOLIDATED-BATHURST LTD., PORTAGE DU FORT (QUEBEC).
Primary Effluent Treatment at (Consolidated-Bathurst Ltd.) Pontiac (Division, Quebec),
W79-05416 5D

CONWED CORP., ST. PAUL, MN. (ASSIGNEE).
Ballasted Floating Barrier Boom,
W79-05376 5G

CORNELL PUMP CO., PORTLAND, OR.
Irrigation Efficiency in Scheduling,
W79-05304 3F

CORNELL UNIV. AGRICULTURAL EXPERIMENT STATION, ITHACA, NY. DEPT. OF AGRICULTURAL ECONOMICS.
Water Production Functions for Irrigated Agriculture,
W79-05275 3F

CORNELL UNIV. AGRICULTURAL EXPERIMENT STATION, ITHACA, NY. DEPT. OF AGRONOMY.
Effect of Sulfur Dioxide on Algae,
W79-05352 5C

CORNELL UNIV., ITHACA, NY. DEPT. OF GEOLOGICAL SCIENCES.
Wear of Unsound Pebbles in River Headwaters,
W79-05016 2J

CORNELL UNIV. MEDICAL COLL., NEW YORK. DEPT. OF MICROBIOLOGY.
Nitrogen Fixation (Acetylene Reduction) by Epiphytes of Freshwater Macrophytes,
W79-05338 5C

CORVALLIS ENVIRONMENTAL PROTECTION AGENCY, OR. WESTERN FISH TOXICOLOGY STATION.
Survival of Salmon Smolts in Sea Water After Exposure to Air-Supersaturated Water,
W79-05191 5B

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR. WESTERN FISH TOXICOLOGY STATION.
Effects of Continuous Zinc Exposure on Sockeye Salmon During Adult-to-Smolt Freshwater Residency,
W79-05203 5C

DALLAS DEPT. OF PUBLIC WORKS, TX.
Flood-Plain Management in Dallas, Tex.: 1908-1978,
W79-05272 6F

DARTMOUTH COLL., HANOVER, NH. DEPT. OF BIOLOGICAL SCIENCES.
Substrate Selection by Larvae of the Sessile Rotifer Ptygura Beauchampi,
W79-05345 5C

DELAWARE UNIV., NEWARK. DEPT. OF AGRICULTURAL ENGINEERING.
Nonpoint Source Pollution from Coastal Plain Soils in Delaware,
W79-05065 5B

DELAWARE UNIV., NEWARK. DEPT. OF CIVIL ENGINEERING; AND DELAWARE UNIV., NEWARK. COLL. OF MARINE STUDIES.
Wave-Current Interaction Models for Rip Currents,
W79-05267 2L

DEPARTMENT OF AGRICULTURE, OTTAWA (ONTARIO). ANIMAL RESEARCH INST.
Physical Quality and Sediment Transport in Drainage Water from a Manured and Fertilized Cropping Operation,
W79-05339 5G

DEPARTMENT OF AGRICULTURE, SWIFT CURRENT (SASKATCHEWAN). RESEARCH STATION.
Variability of Soil Water Retention Curves and Predicted Hydraulic Conductivities on a Small Plot,
W79-05136 2G

DEPARTMENT OF ENERGY, WASHINGTON, DC. DIV. OF BIOMEDICAL AND ENVIRONMENTAL RESEARCH.
Chlorine Application for the Control of Condenser Fouling,
W79-05489 5C

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). WATER RESOURCES BRANCH.
Development of a Hydrologic Model for a Canadian Watershed,
W79-05280 2A

DOMTAR FINE PAPERS, CORNWALL (ONTARIO).
Primary Effluent Treatment at Domtar (Fine Papers Ltd.) Cornwall Mill,
W79-05418 5D

DOW CHEMICAL U.S.A., FREEPORT, TX. TEXAS DIV.
An Engineering Evaluation of the Long-Tube Vertical Falling-Film Distillation Process.
W79-05076 3A

DREXEL UNIV., PHILADELPHIA, PA. DEPT. OF CHEMISTRY; AND DREXEL UNIV., PHILADELPHIA, PA. ENVIRONMENTAL STUDIES INST.
Evaluation of the Capability of Granular Activated Carbon and Resins to Remove Chlorinated and Other Trace Organics from Treated Drinking Water,
W79-05478 5C

DUNN GEOSCIENCE CORP., LATHAM, NY.
Ground-Water Pollution--A Limited Problem,
W79-05122 5B

DUNSTAFFINAGE MARINE RESEARCH LAB., OBAN (SCOTLAND).
Steady-State Energetics of a Planktonic Herbivore,
W79-05326 5C

ECODYNE CORP., LINCOLNSHIRE, IL. (ASSIGNEE).
Method and Apparatus for Separating Solids from Liquids,
W79-05381 5D

ECOLE PRATIQUE DES HAUTES ETUDES, PARIS (FRANCE). LAB. DE BIOCHIMIE ET ECOLOGIE DES INVERTEBRES MARINS; AND CENTRE D'OCEANOGRAPHIE, MARSEILLE (FRANCE). STATION MARINE D'ENDOUME.
Extreme Temperature Tolerance of Palaemon Serratus (Pennant): Influence of Size and Acclimation) Tolerance Aux Temperatures Extremes de Palaemon Serratus (Pennant): Influence de la Taille et de L'Acclimatation,
W79-05102 5C

ECOLOGY CONSULTANTS, INC., FORT COLLINS, CO.
An Evaluation of the Status, Life History, and Habitat Requirements of the Endangered and Threatened Fishes of the Upper Colorado River System. Part Two,
W79-05114 5A

ECONOTECH SERVICES LTD., OTTAWA (ONTARIO).
Development of a Practical Method to Reduce the Toxicity of Kraft Mill Effluents by Retaining some of the Toxic Materials with the Pulp,
W79-05424 5D

EDDY FOREST PRODUCTS LTD., ESPANOLA (ONTARIO).
The Impact of Oxygen Delignification System on Screen Room and Bleach Plant Effluents,
W79-05423 3E

ENGINEERING CONSULTANTS, INC., DENVER, CO.
Sizing of Reservoirs for Periodic-Stochastic Input and Periodic Output,
W79-05029 2H

Expected Asymptotic Maximum Deficit for Periodic-Stochastic Reservoir Inflows in Case of Partial Flow Regulation,
W79-05145 2H

ENVIRONMENTAL PROTECTION AGENCY, CHICAGO, IL. REGION V.
State Ground-Water Protection Programs--A National Summary,
W79-05130 5G

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH.
Distributing Regional Services Costs,
W79-05276 6C

The Epidemiologic Approach to the Evaluation of Organics in Drinking Water,
W79-05464 5C

ENVIRONMENTAL PROTECTION AGENCY, DALLAS, TX.
The Federal Ground-Water Protection Program--Today's Hope,
W79-05128 5G

ENVIRONMENTAL PROTECTION AGENCY, GULF BREEZE, FL.; AND ENVIRONMENTAL RESEARCH LAB., JOHNS ISLAND, SC. BEARS BLUFF FIELD STATION.
Toxicity Screening of Fifteen Chlorinated and Brominated Compounds Using Four Species of Marine Phytoplankton,
W79-05457 5C

Seasonal Chronic Toxicity of Chlorination to the American Oyster, Crassotrea Virginica (G),
W79-05458 5C

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. EFFLUENT GUIDELINES DIV.
Status of Regulation Development for Cooling Water Discharges from Power Plants,
W79-05495 5C

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF AIR AND WATER PROGRAMS.
Environmental Changes from Long-Term Land Application of Municipal Effluents,
W79-05323 5C

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF DRINKING WATER.
Ground-Water Quality Standards--Relevant,
W79-05124 5B

The Federal Ground-Water Protection Program--A Review,
W79-05127 5G

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF RESEARCH AND DEVELOPMENT.
Stormwater Management Model: Transfer of Technology,
W79-05412 5B

ENVIRONMENTAL PROTECTION SERVICE, EDMONTON(ALBERTA).
The Growth Patterns of Some Enteric Bacteria in a Kraft Pulp Mill/Domestic Sewage Combined Treatment System,
W79-05420 5D

ENVIRONMENTAL RESEARCH LAB., DULUTH, MN.
Brominated Compounds Found in Waste-Treatment Effluents and Their Capacity to Bioaccumulate,
W79-05449 5C

ERCO ENVIROTECH LTD., LONDON (ENGLAND).
Bleach Plant Operation,
W79-05497 3E

EXETER UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
A Multivariate Model of Storm-Period Solute Behaviour,
W79-05144 5B

FAR EAST STATE UNIV., VLADIVOSTOK (USSR).
Reaction of Soybeans to Overflooding of Soil, (In Russian),
W79-05284 2I

FARM BUREAU SERVICES, INC., HART, MI.
Trickle Design for Midwest Conditions,
W79-05310 3F

FEDERAL HIGHWAY ADMINISTRATION, SACRAMENTO, CA. CALIFORNIA DIV.
Interdisciplinary Team Approach to Mitigating Adverse Environmental Impacts of Highway Construction,
W79-05236 6G

FEDERAL HIGHWAY ADMINISTRATION, TALLAHASSEE, FL. FLORIDA DIV.
Silt Barriers as Erosion Pollution Control in a Large Recreational Lake,
W79-05237 4D

FEDERAL UNIV. OF PARAIBA, CAMPINA GRANDE (BRAZIL). DEPT. OF CIVIL ENGINEERING.
A Water Demand and Wastewater Disposal Model for Optimum Transfer of Water Resources Technology in Developing Countries,
W79-05413 6D

FISH & WILDLIFE SERVICE, HADLEY, MA.
Transportation of Adult American Shad Past Dams on the Connecticut River, Massachusetts, 1973-76,
W79-05174 5C

FLORIDA STATE GAME AND FRESHWATER FISH COMMISSION, BOCA RATON.
Self-Contained Upwelling System for Rearing Larval Fishes in the Laboratory,
W79-05182 5A

FLORIDA UNIV., GAINESVILLE.
Predicting Dispersion Coefficients in Soils,
W79-05067 2G

FLORIDA UNIV., GAINESVILLE. DEPT. OF AGRICULTURAL ENGINEERING.
Modeling Nitrogen Movement in Agricultural Watersheds,
W79-05069 2G

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING SCIENCES.
Urban Rainfall-Runoff-Quality Data Base,
W79-05282 2A

FLORIDA UNIV., GAINESVILLE. WATER RESOURCES RESEARCH CENTER.
Analysis of Researchable Water Problems in the South Atlantic-Gulf Region,
W79-05401 9D

FLOW RESEARCH CO., KENT, WA.
The Transport and Behavior of Oil Spilled in and Under Sea Ice,
W79-05224 5C

FLUOR CORP. LTD., WHITTIER, CA. RESEARCH DIV.
Preliminary Design Study of an Optimum Nuclear Reactor-Saline Water Evaporator Process,
W79-05369 3A

FLUOR-SINGMASTER AND BREYER, INC., NEW YORK.
Absorption-Multistage Flash Distillation Process,
W79-05366 3A

FOREST SERVICE, WASHINGTON, DC.
Non-Point Water Quality Modeling in Wildland Management: A State-of-The-Art Assessment. (Volume I. Text).
W79-05269 5C

Non-Point Water Quality Modeling in Wildland Management: A State-of-the-Art Assessment (Volume II - Appendixes).
W79-05270 5G

FRENCH EMBASSY, WASHINGTON, DC.
Control of Oil Pollution by Remote Sensing Along the Shores of France,
W79-05392 7B

GENERAL DYNAMICS CO., SAN DIEGO, CA.
Acid Mine Water Reverse Osmosis Test at Kittanning, Pennsylvania,
W79-05071 3A

GENERAL ELECTRIC CO., BURLINGTON, VT.
Operation and Maintenance of 37,000 GPD Thin-Film Distillation Pilot Plant.
W79-05079 3A

Economic and Technical Evaluation of the Wiped Film Evaporator,
W79-05358 3A

GEOLOGICAL SURVEY, ANCHORAGE, AL. WATER RESOURCES DIV.
Summary Appraisals of the Nation's Ground-Water Resources--Alaska,
W79-05153 2F

GEOLOGICAL SURVEY, CARSON CITY, NY. WATER RESOURCES DIV.
Flood and Related Debris Flow Hazards Map,
W79-05165 7C

GEOLOGICAL SURVEY, DORAVILLE, GA. WATER RESOURCES DIV.
Magnitudes, Nature, and Effects of Point and Nonpoint Discharges in the Chattahoochee River Basin, Atlanta to West Point Dam, Georgia,
W79-05157 5B

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.
Characteristics of Pennsylvania Recreational Lakes,
W79-05168 2H

GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV.
Water Resources Data for Montana, Water Year 1977.
W79-05162 7C

GEOLOGICAL SURVEY, JACKSONVILLE, FL. WATER RESOURCES DIV.
7-Day Low Flows and Flow Duration of Alabama Streams Through 1973,
W79-05166 2E

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
Scour and Fill in a Stream Channel, East Fork River, Western Wyoming,
W79-05149 2J

Summary Appraisals of the Nation's Ground-Water Resources--Missouri Basin Region,
W79-05152 7C

Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado, 1975-76,
W79-05164 2F

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.; AND GEOLOGICAL SURVEY, SIOUX FALLS, SD. WATER RESOURCES DIV.
Preliminary Applications of Landsat Images and Aerial Photography for Determining Land-Use, Geologic and Hydrologic Characteristics--Yampa River Basin, Colorado and Wyoming,
W79-05163 7B

GEOLOGICAL SURVEY, LINCOLN, NE. WATER RESOURCES DIV.
Nebraska Water Data Programs, 1978,
W79-05160 7C

Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska,
W79-05161 4B

GEOLOGICAL SURVEY, LINCOLN, NE. WATER RESOURCES DIV.; AND NEBRASKA UNIV., LINCOLN. CONSERVATION AND SURVEY DIV.
Groundwater Levels in Nebraska, 1977,
W79-05150 2F

GEOLOGICAL SURVEY, LITTLE ROCK, AR. WATER RESOURCES DIV.
Water-Quality Investigation of the Vache Grasse Creek Watershed, Sebastian County, Arkansas,
W79-05158 6A

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
Summary of Watershed Conditions in the Vicinity of Redwood National Park, California,
W79-05170 4D

Reconnaissance Assessment of Erosion and Sedimentation in the Canada De Los Alamos Basin, Los Angeles and Ventura Counties, California,
W79-05172 2J

Numerical Modeling of Liquid Geothermal Systems,
W79-05173 1A

GEOLOGICAL SURVEY, PHOENIX, AZ. WATER RESOURCES DIV.; GEOLOGICAL SURVEY, JACKSON, MS. WATER RESOURCES DIV.; AND GEOLOGICAL SURVEY, CHARLESTON, WV. WATER RESOURCES DIV.
Summary Appraisals of the Nation's Ground-Water Resources--South Atlantic-Gulf Region,
W79-05154 2F

GEOLOGICAL SURVEY, PORTLAND, OR. WATER RESOURCES DIV.
Analysis of Urban Storm-Water-Quality from Seven Basins Near Portland, Oregon,
W79-05156 5B

Storm-Water Data for Bear Creek Basin, Jackson County, Oregon, 1977-78,
W79-05171 5B

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
The United States Geological Survey in Alaska: Accomplishments During 1977.
W79-05167 7C

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV., AND GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Evaluation and Design of a Streamflow-Data Network in Washington,
W79-05159 7A

GEOLOGICAL SURVEY, SYOSSET, NY. WATER RESOURCES DIV.
Artificial Recharge on Long Island, New York,
W79-05169 4B

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Biscayne Aquifer, Southeast Florida,
W79-05155 5B

GEOLOGICAL SURVEY, TUCSON, AZ. WATER RESOURCES DIV.
Annual Summary of Ground-Water Conditions in Arizona, Spring 1977 to Spring 1978,
W79-05151 4B

GEORGIA INST. OF TECH., ATLANTA. ENVIRONMENTAL RESOURCES CENTER.
Nitrification with Rotating Biological Contactor Systems,
W79-05047 5D

Microbial Degradation of Dye Wastes in Aqueous Effluents,
W79-05048 5D

GEORGIA UNIV., ATHENS. INST. OF NATURAL RESOURCES.
The Law of Surface Water Allocation in Georgia,
W79-05415 6E

GEORGIA UNIV., SAVANNAH. COASTAL PLAIN STATION.
Fingerling American Shad: Effect of Valium, MS-222, and Sodium Chloride on Handling Mortality,
W79-05179 5B

GHENT RIJKSUNIVERSITEIT (BELGIUM). FACULTEIT LANDBOUWWETENSCHAPPEN.
Size Distribution of Eroded Material from Simulated Rainfall: Effect Over a Range of Texture,
W79-05259 2J

GIPROBUM (USSR).
Control of Activated Sludge Bulking During Biological Purification (Regulirovanie prirosta aktivnogo ila pri biologicheskoi ochistke),
W79-05431 5D

GORDON COLL., WENHAM, MA. DEPT. OF BIOLOGY.
Measurement and Significance of Specific Activity in the Heterotrophic Bacteria of Natural Waters,
W79-05490 5A

GRONINGEN RIJKSUNIVERSITEIT (NETHERLANDS). DEPT. OF SYSTEMIC BOTANY.
The Short Day Response in Acrosymphyton Purpuriferum (J. Ag.) Sjost. (Rhodophyceae, Crytonemiales),
W79-05325 5C

GUELPH UNIV. (ONTARIO). DEPT. OF LAND RESOURCE SCIENCE.
The Applicability of Dual Gamma Scanning to Freezing Soils and the Problem of Stratification,
W79-05260 2C

GUELPH UNIV. (ONTARIO). DEPT. OF NUTRITION.
The Chemical Composition of Aquatic Macrophytes. II. Amino Acid Composition of the Protein and Non-Protein in Fractions,
W79-05330 5C

GUTTERIDGE, HASKINS AND DAVEY (PTY) LTD., MELBOURNE (AUSTRALIA).
Toxicity of Treated and Untreated P. (Pinus) Radiata TMP (Thermomechanical Pulping) Effluents on a Number of Organisms,
W79-05426 5C

HALIBURTON CO., DUNCAN, OK. (ASSIGNEE).
Method of Clarifying and Removing Water from Water-Solids Suspensions,
W79-05383 5D

HAMPTON ROADS SANITATION DISTRICT, VIRGINIA BEACH, VA.
A Comparison of Bromine Chloride and Chlorine as Wastewater Disinfectants in Pilot Plant Studies,
W79-05485 5C

HARVARD UNIV., CAMBRIDGE, MA. DIV. OF APPLIED SCIENCES.
Precursors and Mechanisms of Haloform Formation in the Chlorination of Water Supplies,
W79-05438 5A

HAWAII UNIV., HONOLULU. DEPT. OF CHEMISTRY.
Some Results from Recent Chemical Studies at Kilauea Volcano, Hawaii,
W79-05003 5A

Fume Compositions Found at Various Stages of Activity at Kilauea Volcano, Hawaii,
W79-05004 5A

HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER.
Digital Simulation and Evaluation of Storm Drainage Systems: St. Louis Heights Watershed Model,
W79-05225 2A

HERCULES INC., WILMINGTON, DE.
Process for Inhibiting Corrosion of Metals in Aqueous Systems,
W79-05391 5F

HICKOK (EUGENE A.) ASSOCIATES, WAYZATA, MN.
Systematic Diurnal Curve Analysis,
W79-05042 5B

HOKKAIDO SALMON HATCHERY, SAPPORO (JAPAN).
Ecological Observation on the Adult Salmon: I. Diurnal Variation of Upstream Migration of the Adult Chum Salmon in the Chitose River (In Japanese),
W79-05348 6G

HUNTER COLL., NEW YORK. SCHOOL OF HEALTH SCIENCES.
A Case Control Study of Gastrointestinal and Urinary Tract Cancer Mortality and Drinking Water Chlorination,
W79-05465 5C

HYDRAULICS RESEARCH STATION, WALLINGFORD (ENGLAND).
Modeling Two-Dimensional Circulating Flow,
W79-05255 8B

HYDROCOMP, INC., PALO ALTO, CA.
Continuous Simulation for Water Quality Planning,
W79-05010 6B

IDAHO UNIV., MOSCOW. DEPT. OF AGRICULTURAL ENGINEERING.
Drainage in a Natural Layered Profile by Finite Element Analysis,
W79-05051 2G

Controlling Irrigation Runoff Losses with Proper Management,
W79-05059 4A

IDAHO UNIV., MOSCOW. DEPT. OF ENTOMOLOGY.
Interacting Effects of Minimum Flow and Fluctuating Shorelines on Benthic Stream Insects,
W79-05233 2E

ILLINOIS STATE GEOLOGICAL SURVEY, URBANA.
Ground-Water Pollution--A Status Report,
W79-05120 5C

ILLINOIS STATE WATER SURVEY, URBANA.
Development and Evaluation of a Two-Step Membrane Filter Method for Fecal Coliform Recovery in Chlorinated Sewage Effluents,
W79-05012 5A

Record Winter Storms in Illinois, 1977-1978,
W79-05013 2B

INDIAN INST. OF TECH., KHARAGPUR. DEPT. OF CIVIL ENGINEERING.
Effective Depth in Channels Having Bed Undulations,
W79-05254 2J

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
A Non-Linear Optimization Method for the Estimation of Aquifer Parameters,
W79-05026 2F

INSTITUTE OF ICHTHYOLOGY, SZCZECIN (POLAND).
Effect of Phenol Upon Activation and Fertilization Ability of Rainbow Trout Spermatozoa (Salmo Gairdneri Rich.) (In Polish),
W79-05176 5C

INSTITUTE PLANT PHYSIOLOGY, SOFIA (BULGARIA).
Effect of Transpiration Rate on the Uptake of Mineral Elements by Alfalfa Plants (In Bulgarian),
W79-05321 2I

INSTYTUT TECHNOLOGII ZYM ZYWNOSCI POCHODZINIA MORSKIEGO, SZCZECIN (POLAND).
Comparative Studies on Methods for Determining Total Mercury in Fish. Dithizone and Flameless Atomic Absorption Spectrophotometry Techniques,
W79-05183 5B

INSTYTYT TECHNOLOGII ZYM ZYWNOSEI POCHODZENIA MORSKIEGO, SZCZECIN (POLAND).
Insecticides: HCH, DDT, DDE, and DDD in Selected Pacific Commercial Fish Species (In Polish),
W79-05199 5B

INTERNATIONAL PAPER CO., DALHOUSIE (NEW BRUNSWICK).
White Water Recycled at C.I.P. (Canadian International Paper Co.), Dalhousie, N.B.,
W79-05421 3E

IONICS, INC., WATERTOWN, MA.
Results of Selected Laboratory Tests of an Ionics Demineralizer,
W79-05363 3A

IOWA STATE UNIV., AMES. DEPT. OF AGRICULTURAL ENGINEERING.
Washoff of Herbicides Applied to Corn Residue,
W79-05036 5B

Movement of Pesticides and Nutrients with Water and Sediment as Affected by Tillage Practices: A Field Study,
W79-05050 5B

Plant Nutrient Losses from Foliar-Fertilized Soybeans,
W79-05056 5G

IOWA UNIV. IOWA CITY. INST. OF HYDRAULIC RESEARCH.
Mixing of Power-Plant Heated Effluents with the Missouri River,
W79-05245 5B

JAMES COOK UNIV. OF NORTH QUEENSLAND, TOWNSVILLE (AUSTRALIA). DEPT. OF GEOLOGY.
The Development of Overland Flow in a Tropical Rainforest Catchment,
W79-05030 2A

JET PROPULSION LAB., PASADENA, CA.
Chlorine and Activated Carbon Treatment for Removal of Toxic Substances From Water,
W79-05487 5C

JOHNS-MANVILLE SALES CORP., FRESNO, CA. AG-TURF DIV.
IA Sprinkler Test Standards,
W79-05313 3F

JYVASKYLA UNIV. (FINLAND). DEPT. OF BIOLOGY.
Mercury in Sediments of Lake Paijanne, Finland,
W79-05340 5C

KANSAS ENGINEERING EXPERIMENT STATION, MANHATTAN.
Analysis and Optimization of a Reverse Osmosis Water Purification System,
W79-05073 3A

KANSAS WATER RESOURCES RESEARCH INST., MANHATTAN.
Kansas River Limnology: Seasonal Variations in Photosynthetic Production and Heavy Metal Accumulation by Aquatic Insects,
W79-05234 5C

KARLSRUHE UNIV. (GERMANY, F.R.). INST. FUER HYDROMECHANIK.
Computation of Shallow Water Waves with Hybrid Finite Elements,
W79-05022 2L

KATHOLIEKE UNIV., NIJMEGEN (NETHERLANDS). LAB. VOOR AQUATISCHE OECOLOGIE.
Algae of Saltmarshes on the South and Southwest Coasts of England,
W79-05335 5C

KENTUCKY UNIV., LEXINGTON. DIV. OF REGULATORY SERVICES.
Copper, Nickel, and Zinc Released from Acid Coal Mine Spoil Materials of Eastern Kentucky,
W79-05044 5A

KOPPERS CO. INC., PITTSBURGH, PA.
The Koppers Hydrate Process for Saline Water Conversion Experimental and Engineering Studies,
W79-05368 3A

KUYBYSHEVSKII SELSKOKHOZYAISTVENNYI INST., KINEL (USSR).
Dynamic Changes in pH and Composition of Absorbed Cations in Irrigated Chernozems of the Trans-Volga Area (In Russian),
W79-05226 2K

LENINGRAD STATE PEDAGOGICAL INST. (USSR).
Effect of Soil Humidity on Nitrate Reductase Activity in Barley Shoot Leaves (In Russian),
W79-05314 2I

LIIA EDET AKTIEBOLAG (SWEDEN). (ASSIGNEE).
Process for Purifying Waste Water Obtained by a Papermaking Process,
W79-05386 5D

LINDSAY MFG. CO., NE. (ASSIGNEE).
Water Drive System for a Center Pivot Irrigation Unit or the Like,
W79-05387 3F

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF AGRICULTURAL ENGINEERING.
Trickle Irrigation in Humid Zones,
W79-05311 3F

LOUISIANA STATE UNIV., BATON ROUGE. FISHERIES DIV.
Acute Toxicity of Permethrin to Several Aquatic Animals,
W79-05207 5C

LOUISVILLE UNIV., KY. DEPT. OF BIOLOGY.
Rapid Vacuum Method for Removal of Mucus from the Epidermis of Fishes,
W79-05180 5A

Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development,
W79-05212 5C

LOUISVILLE WATER CO., KY.
Trihalomethane Reduction at the Louisville Water Company,
W79-05481 5C

MACDONALD COLL., STE. ANNE DE BELLEVUE (QUEBEC). DEPT. OF AGRICULTURAL ENGINEERING.
Drainage Rates and Water-Table Depths,
W79-05137 2G

MAINE UNIV. AT FARMINGTON. DEPT. OF CHEMISTRY.
Toxicity of Copper to Cutthroat Trout (Salmo Clarki) Under Different Conditions of Alkalinity, pH, and Hardness,
W79-05107 5A

MAINE UNIV. AT ORONO. CENTER FOR MARINE STUDIES.
The Phytoplankton Characteristics of the Barrier Island Lagoons of the Gulf of California,
W79-05337 5C

MAINE UNIV., WALPOLE. IRA C. DARLING CENTER FOR RESEARCH, TEACHING AND SERVICE.
The Use of Species Abundance Estimates in Marine Benthic Studies,
W79-05109 5A

MANITOBA UNIV., WINNIPEG. DEPT. OF AGRICULTURAL ENGINEERING.
Center Pivots on Soils Marginally Suited for Irrigation in Manitoba, Canada,
W79-05291 3F

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM, PLYMOUTH (ENGLAND). PLYMOUTH LAB.
Editorial Introduction,
W79-05188 5A

Notes on the Condition in September 1978 of Some Intertidal Sands Polluted by Amoco Cadiz Oil,
W79-05193 5B

On the Nutrition and Metabolism of Zooplankton. XII. Measurements by Radioimmunoassay of the Levels of a Steroid In Calanus,
W79-05334 5C

MARLBOROUGH CATCHMENT AND REGIONAL WATER BOARD, BLENHEIM, (NEW ZEALAND).
Output of Water, Suspended Sediment, and Phosphorus Forms from a Small Agricultural Catchment,
W79-05344 5B

MARTIN MARIETTA CORP., BALTIMORE, MD.
Bromine Chloride - An Alternative Biofouling Control Agent for Cooling Water Treatment,
W79-05493 5C

MARYLAND UNIV., COLLEGE PARK. DEPT. OF CHEMISTRY.
Chlorine Degradation and Halocarbon Production in Estuarine Waters,
W79-05451 5A

MARYLAND UNIV., COLLEGE PARK. DEPT. OF MICROBIOLOGY.
Detection of Enteroviruses and Bacterial Pathogens Surviving Standard Sewage Treatment,
W79-05090 5B

Vibrio Cholerae, Vibrio Parahaemolyticus, and other Vibrios: Occurrence and Distribution in Chesapeake Bay,
W79-05104 5C

MARYLAND UNIV., FROSTBURG. APPALACHIAN ENVIRONMENTAL LAB.
Modifications of Temperature Avoidance Troughs for Testing Small Fishes,
W79-05185 5A

MASON-RUST, LOUISVILLE, KY.
Third Annual Report: Brackish Water Conversion Demonstration Plant, Webster, South Dakota.
W79-05078 3A

MASON-RUST, WEBSTER, SD.
An Engineering Evaluation of the Electrodialysis Process Adapted for Computer Methods for Water Desalination Plants.
W79-05081 3A

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Solidification and Separation of Ice from Saline Water,
W79-05357 3A

MASSACHUSETTS UNIV., AMHERST. DEPT. OF FOOD AND RESOURCE ECONOMICS.
An Economic Valuation of Recreational Clamming in Massachusetts,
W79-05316 6B

MASSACHUSETTS UNIV., AMHERST. WATER RESOURCES RESEARCH CENTER.
Connecticut River Diversion: A Case Study in Water Allocation Policy,
W79-05414 6B

MASSACHUSETTS UNIVERSITY, AMHERST. DEPARTMENT OF FORESTRY AND WILDLIFE MANAGEMENT.
Influence of Waste Residuals in Estuarine Waters on Development, Behavior and Survival of Soft-Shell Clam Larvae,
W79-05398 5C

MATTHEY RUSTENBURG REFINERS (PTY) LTD., JOHANNESBURG (SOUTH AFRICA). (ASSIGNEE).
Treatment of Effluents,
W79-05385 5D

MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF GEOLOGY.
Fluvial Processes and Facies Sequences in the Sandy Braided South Saskatchewan River, Canada,
W79-05135 2J

MEDICAL ACADEMY, GDANSK (POLAND). INST. OF MEDICAL BIOLOGY.
Effect of DBS Detergent on Activity of Some Enzymes of Young Carp (Cyprinus carpio L.) Brain, Gills and Serum,
W79-05177 5C

MIAMI UNIV., OXFORD, OH. DEPT. OF BOTANY.
Observations on Hypnospores in Ulothrix Zonata (Chlorophyceae),
W79-05428 5C

MICHIGAN DEPT. OF PUBLIC HEALTH, LANSING.
Ground-Water Quality Standards--A Neutral View,
W79-05123 5B

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF CROP AND SOIL SCIENCE.
Scheduling of Water and Nitrogen for Corn in the Humid Midwest,
W79-05295 3F

MICHIGAN UNIV., ANN ARBOR.
Comparison Theorems for Gravity Waves in Basins of Variable Depth,
W79-05253 2H

MICHIGAN UNIV., ANN ARBOR. DEPT. OF APPLIED MECHANICS AND ENGINEERING SCIENCE.
Internal Waves in a Circular Channel,
W79-05250 2H

MICHIGAN UNIV., ANN ARBOR. DEPT. OF ENVIRONMENTAL AND INDUSTRIAL HEALTH.
The Effect of Preozonation on Chloroform Production in the Chlorine Disinfection Process,
W79-05480 5C

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, BURNHAM-ON-CROUCH (ENGLAND). FISHERIES LAB.
Petroleum Hydrocarbon Analyses Conducted Following the Wreck of the Supertanker Amoco Cadiz,
W79-05196 5A

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, LOWESTOFT (ENGLAND).
Effect of Algal Diet and Temperature on the Biochemical Composition of the Rotifer, Brachionus Plicatilis,
W79-05341 5C

MINNESOTA DEPT. OF HEALTH, MINNEAPOLIS.
State Ground-Water Protection Programs--Adequate,
W79-05132 5G

MINNESOTA UNIV., DULUTH. DEPT. OF CHEMISTRY.
Aqueous Chlorination Products of Polynuclear Aromatic Hydrocarbons,
W79-05440 5A

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF CIVIL AND MINERAL ENGINEERING.
Distributed Sources for Unconfined Groundwater Flow in a Half-Space,
W79-05025 2F

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. DEPT. OF BOTANY.
Diatom Community Structure: Taxonomic and Statistical Analyses of a Mississippi Salt Marsh,
W79-05007 5C

MISSOURI UNIV.-COLUMBIA. DEPT. OF CHEMISTRY.
Wastewater Treatment with Humic Acid-Fly Ash Mixtures,
W79-05006 5D

MISSOURI UNIV.-COLUMBIA. DEPT. OF CIVIL ENGINEERING.
Effect of Phosphorus Supply on Algal Biomass in a Turbid Missouri Reservoir,
W79-05001 5C

MISSOURI UNIV.-ROLLA. DEPT. OF CIVIL ENGINEERING.
New Design Criteria for the Aerobic Digestion of Sewage Lime Sludge,
W79-05009 5D

MISSOURI UNIV.-ROLLA. SCHOOL OF ENGINEERING.
A Model for Cost Optimization of Barge Shipments,
W79-05317 6C

MITSUBISHI JUKOGYO KABUSHIKI KAISHA, TOKYO (JAPAN). (ASSIGNEE).
Floating-Refuse-Collecting Boat,
W79-05380 5G

MONSANTO RESEARCH CORP., EVERETT, MA. BOSTON LAB.
Investigation and Preparation of Polymer Films to Improve the Separation of Water and Salts in Saline Water Conversion.
W79-05083 3A

Thermodynamic Properties of Saline Water,
W79-05359 3A

MONTANA STATE UNIV., BOZEMAN.
Defining Upper Limits to Groundwater Development in the Arid West,
W79-05271 4B

MONTGOMERY (JAMES M.) INC., PASADENA, CA. ENVIRONMENTAL RESEARCH LAB.
Optimizing Trihalomethane Analysis,
W79-05476 5A

MOSKOVSKAYA SELSKOKHOZYAISTVENNAYA AKADEMIYA (USSR). DIV. OF FARMING EXPERIMENT METHODS.
Water Demand and Yield of Grain Crops in Cultivation Systems of Different Intensity, (In Russian),
W79-05336 2I

MOSUL UNIV. (IRAQ). DEPT. OF CIVIL ENGINEERING.
A Simple Version of Gumbel's Method for Flood Estimation,
W79-05256 2E

MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OH.
A Study of Alternatives to Chlorination for Disinfection of Wastewater,
W79-05483 5C

Ultraviolet Disinfection of Municipal Effluents,
W79-05488 5D

MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OH. WATER SUPPLY RESEARCH DIV.
Ozone, Chlorine Dioxide and Chloramines as Alternatives to Chlorine for Disinfection of Drinking Water,
W79-05477 5C

NALCO CHEMICAL CO., CHICAGO, IL.
Controlling Iron Oxide Deposition in Boiler Systems,
W79-05498 3C

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.
Snow-Covered Area Utilization in Runoff Forecasts,
W79-05140 2C

NATIONAL CANCER INST., BETHESDA, MD.
Risk Assessment of the Health Effects of Water Chlorination,
W79-05473 5C

NATIONAL FISHERY RESEARCH LAB., LACROSSE, WI.
Announcement of Compounds Registered for Fishery Uses,
W79-05205 5A

NATIONAL MARINE FISHERIES SERVICE, AUKE BAY, AK. NORTHWEST AND ALASKA FISHERIES CENTER.
Acute and Chronic Toxicity, Uptake and Depuration, and Sublethal Metabolic Response of Alaskan Marine Organisms to Petroleum Hydrocarbons,
W79-05215 5C

NATIONAL MARINE FISHERIES SERVICE, BEAUFORT, NC. BEAUFORT LAB.
Modified Neuston Net for Collecting Live Larval and Juvenile Fish,
W79-05211 5A

NATIONAL MARINE FISHERIES SERVICE, HIGHLANDS, NJ. SANDY HOOK LAB.
Effects of Elevated Temperature on Early Embryonic Development of the Tautog, Tautoga Onitis,
W79-05204 5C

NATIONAL MARINE FISHERIES SERVICE, HIGHLANDS, NJ. SANDY HOOK SPORT FISHERIES MARINE LAB.
Pollution-Associated Diseases and Abnormalities of Fish and Shellfish: A Review,
W79-05097 5C

NATIONAL MARINE FISHERIES SERVICE, HONOLULU, HI. SOUTHWEST FISHERIES CENTER.
Mercury and Selenium in Blue Marlin, Makaira Nigricans, from the Hawaiian Islands,
W79-05113 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWEST AND ALASKA FISHERIES CENTER.
Effect of Thermal Increases of Short Duration on Survival of Euphausia Pacifica,
W79-05101 5C

Analysis of Chlorinated Hydrocarbon Pollutants: A Simplified Extraction and Cleanup Procedure for Fishery Products,
W79-05110 5A

Dip Basket for Collecting Juvenile Salmon and Trout in Gatewells at Hydroelectric Dams,
W79-05175 5A

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05216 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MI. GREAT LAKES ENVIRONMENTAL RESEARCH LAB.
Characteristics of the Oswego River Plume and Its Influence on the Nearshore Environment,
W79-05118 2E

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, CO. ENVIRONMENTAL RESEARCH LABS.
The Amoco Cadiz Oil Spill. A Summary of Observations Made By U.S. Scientists 23 March-10 May, 1978,
W79-05195 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, CO. MARINE ECOSYSTEMS ANALYSIS PROGRAM OFFICE.
The MESA Puget Sound Project, Seattle, Washington. Fiscal year 1977 - Annual Report.
W79-05115 5C

MESA New York Light Project Annual Report for Fiscal Year 1977.
W79-05116 5B

Heavy Metal Concentrations at the Apex of the New York Bight,
W79-05117 5A

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABS.
Wind-Induced Current Flow in the Upper Hudson Shelf Valley,
W79-05266 2L

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMIA, FL. ATLANTIC OCEANOGRAHIC AND METEOROLOGICAL LABS.
Near-Bottom Sediment Concentration and Fluid Velocity Measurements on the Inner Continental Shelf, New York,
W79-05268 2L

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SEATTLE, WA. PACIFIC MARINE ENVIRONMENTAL LAB.
Transport Mechanisms and Hydrocarbon Adsorption Properties of Suspended Matter in Lower Cook Inlet,
W79-05218 5C

NEBRASKA UNIV., CLAY CENTER. SOUTH CENTRAL STATION.
Automation of Surface Irrigation,
W79-05305 3F

NEBRASKA UNIV., LINCOLN. DEPT. OF AGRICULTURAL ECONOMICS.
Economics of Irrigation,
W79-05292 3F

NEBRASKA UNIV., LINCOLN. DEPT. OF AGRICULTURAL ENGINEERING.
Limits of Low Pressure Sprinklers and Spray Nozzles on Center Pivot Applications,
W79-05294 3F

Solar Cell Irrigation,
W79-05308 3F

NELSON IRRIGATION CORP., GRAND ISLAND, NE.
Application of End Guns on Center Pivots,
W79-05293 3F

NELSON IRRIGATION CORP., WALLA WALLA, WA.
Optimizing Traveling Sprinkler System Performance,
W79-05299 3F

NEVADA UNIV. SYSTEM, RENO. WATER RESOURCES CENTER.
Digital Simulation of Snowmelt Runoff,
W79-05091 2E

NEW ENGLAND RIVER BASINS COMMISSION, HANOVER, NH.
Plan of Study: Case Studies of the Application of Cost Sharing Policy Options for Flood Plain Management in the Connecticut River Basin.
W79-05232 6F

NEW HAMPSHIRE UNIV., DURHAM. DEPT. OF CHEMISTRY.
Fate of Metal Ions During Domestic Treatment of Water Containing Organics,
W79-05046 5F

NEW HAMPSHIRE UNIV., DURHAM. INST. OF NATURAL AND ENVIRONMENTAL RESOURCES.
Effects of Sludge Applications on Soil Water Solution and Vegetation in a Northern Hardwood Stand.
W79-05002 5E

NEW UNIV. OF ULSTER, COLERAINE (NORTHERN IRELAND). LIMNOLOGY LAB.
The Influence of Turbidity on Net Phytoplankton Photosynthesis in Some Irish Lakes,
W79-05098 5C

NEW YORK OCEAN SCIENCE LAB., MONTAUK.
An Annual Phytoplankton Study in Coastal Waters Off Eastern Long Island (Block Island Sound),
W79-05231 5C

NEW ZEALAND FOREST SERVICE, ROTORUA.
Refiner Pulp Mill Effluent. Part 2. Composition of Dissolved Solids Fraction,
W79-05496 5B

NIPPON PAINT CO. LTD., OSAKA (JAPAN). (ASSIGNEE).
Process for Phosphate Conversion Coating with Treatment of Rinse Water by Reverse Osmosis and Ion Exchange,
W79-05372 5D

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF HORTICULTURAL SCIENCE.
The Use of Overtree Irrigation for Crop Cooling and Frost and Freeze Protection on Apples,
W79-05298 3F

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF ENVIRONMENTAL SCIENCES AND ENGINEERING.
Natural and Model Aquatic Humics: Reactions with Chlorine,
W79-05437 5C

The Effect of Ammonia Concentration on the Chemistry of Chlorinated Sea Water,
W79-05453 5A

NORTH KENNEBEC REGIONAL PLANNING COMMISSION, WINSLOW, ME.
Kennebec River Corridor Plan -- A Management Plan for a Rejuvenated Resource,
W79-05402 6B

Kennebec River Corridor Project -- Appendix I: Demography,
W79-05403 6B

Kennebec River Corridor Project -- Appendix II: Water Resources,
W79-05404 6B

Kennebec River Corridor Project -- Appendix III: Flow Regulation,
W79-05405 6B

Kennebec River Corridor Project -- Appendix IV: Flooding,
W79-05406 6B

Kennebec River Corridor Project -- Appendix V: Management Plan,
W79-05407 6B

NORTH TEXAS STATE UNIV., DENTON. INST. OF APPLIED SCIENCES; AND NORTH TEXAS STATE UNIV., DENTON. DEPT. OF CHEMISTRY.
Soluble Organic Constituents of Natural Waters and Wastewaters Before and After Chlorination,
W79-05436 5A

NORTHEASTERN FOREST EXPERIMENT STATION, DURHAM, NH.
Simulated Streamflow Response to Possible Differences in Transpiration Among Species of Hardwood Trees,
W79-05018 2A

NORTHWESTERN UNIV., EVANSTON, IL. DEPT. OF CIVIL ENGINEERING.
Evaluation of Alternative Chemical Treatments for Biofouling Control in Electric Power Facilities,
W79-05494 5C

NORTHWESTERN UNIV., EVANSTON, IL. DEPT. OF GEOLOGICAL SCIENCES; AND NORTHWESTERN UNIV., EVANSTON, IL. DEPT. OF ENGINEERING SCIENCES AND APPLIED MATHEMATICS.
A Time-Dependent Model of a Coastal Boundary Layer with Friction,
W79-05263 2H

NORTHWESTERN UNIV., EVANSTON, IL. DEPT. OF MECHANICAL ENGINEERING.
Computer Simulation of Bubbler-Induced Melting of Ice Covers Using Experimental Heat Transfer Results,
W79-05279 2C

OAK RIDGE NATIONAL LAB., TN.
The Oak Ridge National Laboratory Conceptual Design of a 250-mgd Desalination Plant.
W79-05072 3A

Mutagenicity and Water Chlorination: Prospect and Perspective,
W79-05466 5C

OAK RIDGE NATIONAL LAB., TN. CHEMISTRY DIV.
A Kinetic Model for Predicting the Composition of Chlorinated Water Discharged from Power Plant Cooling Systems,
W79-05491 5C

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Investigation of the Effects of Halogenated Organic Compounds Produced in Cooling Systems and Process Effluents on Aquatic Organisms,
W79-05448 5C

OFFICE DE LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE OUTRE-MER, PARIS (FRANCE). HYDROLOGY SECTION.
Obtaining Variations of Field Infiltration Capacity from Simulated Rainstorm Experiments (Determination Des Variations De La Capacite D'Absorption D'Un Sol En Place Sous Averses Simulees),
W79-05257 2G

OHIO STATE UNIV., COLUMBUS. DEPT. OF GEOLOGY AND MINERALOGY.
Ground-Water Pollution--An Imminent Disaster,
W79-05121 5C

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRONOMY.
Errors in Gamma-Ray Measurements of Water Content and Bulk Density in Nonuniform Soils,
W79-05251 2G

OKLAHOMA UNIV., NORMAN. DEPT. OF CHEMISTRY. 14-01-001-160.
Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05365 3A

OLIN CORP., NEW HAVEN, CT. RESEARCH AND DEVELOPMENT CENTER.
Reactions of Chlorine, Chlorine Dioxide and Mixtures Thereof with Humic Acid: An Interim Report,
W79-05439 5A

ONTARIO HYDRO, TORONTO.
A Program to Introduce Site-Specific Chlorination Regimes at Ontario Hydro Generating Stations,
W79-05442 5C

ONTARIO-MINNESOTA PULP AND PAPER CO. LTD., FORT FRANCES, (ONTARIO).
Problems Associated with an Aerated Lagoon,
W79-05417 5D

OREGON STATE DEPT. OF ENVIRONMENTAL QUALITY, SALEM. WATER QUALITY DIV.
A Geographically Variable Water Quality Index Used in Oregon,
W79-05043 5B

OREGON STATE UNIV., CORVALLIS.
Comparative Efficiency of Irrigation Systems,
W79-05303 3F

OREGON STATE UNIV., CORVALLIS. DEPT. OF FISHERIES AND WILDLIFE.
Toxicity of Residual Chlorine Compounds to Aquatic Organisms,
W79-05197 5B

OREGON STATE UNIV., CORVALLIS. DEPT. OF MICROBIOLOGY.
Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05220 5C

OREGON STATE UNIV., CORVALLIS. OAK CREEK LAB. OF BIOLOGY.
Toward an Understanding of the Toxicity of Intermittent Exposures of Total Residual Chlorine to Freshwater Fishes,
W79-05444 5C

OXFORD UNIV. (ENGLAND). DEPT. OF ZOOLOGY; AND OXFORD UNIV. (ENGLAND). ANIMAL ECOLOGY RESEARCH GROUP.
Some Ecological Observations on a Permanent Pond in Southern England: Primary Production and Planktonic Seasonal Succession,
W79-05356 5C

PATTERSON FARMS, CHINA GROVE, NC.
The Role of Sprinkler Irrigation in Producing Specialty Crops,
W79-05296 3F

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRICULTURAL ENGINEERING.
Influence of Soil Air and Drainage on Infiltration,
W79-05054 2G

A Simple Finite Element Method of Infiltration,
W79-05064 2G

PENNSYLVANIA UNIV., PHILADELPHIA. DEPT. OF LANDSCAPE ARCHITECTURE AND PENNSYLVANIA UNIV., PHILADELPHIA. REGIONAL PLANNING DIV.
Relationship Between Alluvial Soils and Flooding in the Piedmont Lowland of Southeastern Pennsylvania,
W79-05017 2E

PHILCO, NEWPORT BEACH, CA. RESEARCH LABS.
Investigation of Thermal Diffusion for Saline Water Conversion,
W79-05361 3A

PIRNIE (MALCOLM) INC., SILVER SPRING, MD.
Land Application of Waste--An Accident Waiting to Happen,
W79-05126 5B

POINT REYES BIRD OBSERVATORY, STINSON BEACH, CA.
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05221 5C

POLYTECHNIC INST. OF NEW YORK, BROOKLYN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Conceptual Review and Preliminary Design of Multifarious Water Intake Structures,
W79-05248 8A

PRINCE GEORGE PULP AND PAPER LTD. (BRITISH COLUMBIA).
Effluent Treatment at Prince George Pulp and Paper Ltd.,
W79-05419 5D

PURDUE UNIV. LAFAYETTE, IN. DEPT. OF AGRONOMY.
Surface Runoff from Sludge-Amended Soils,
W79-05041 5B

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF BIONUCLEONICS.
Some Aspects of Sediment Distribution and Macrophyte Cycling of Heavy Metals,
W79-05353 5C

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF BOTANY AND PLANT PATHOLOGY.
Regeneration of Thallus Fragments of Rhodochorton Purpureum (Rhodophyceae, Nemalionales),
W79-05349 5C

PURDUE UNIV., WATER RESOURCES RESEARCH CENTER. LAFAYETTE, IN.
Interactive Multiple Objective Optimization,
W79-05092 6A

QUEBEC UNIV., TROIS RIVIERES (QUEBEC). PULP AND PAPER RESEARCH CENTER.
A Rapid Estimation of 5-Day BOD of Spent Sulfite Liquor,
W79-05500 5A

RAIN BIRD TECHNICAL SERVICES, LOGAN, UT.
Simulated Flow Rate Requirements for Some Flushing Emitters,
W79-05062 8B

Evaluation Criteria for Trickle Irrigation Emission Devices,
W79-05309 3F

RCA LAB. LTD., ZURICH (SWITZERLAND).
Measurement of Dissolved Oxygen,
W79-05434 5A

REINKE MANUFACTURING COMPANY, DESHLER, NE. (ASSIGNEE).
Wind Correction Method and Apparatus for Irrigation Systems,
W79-05379 3F

RESOURCE MANAGEMENT ASSOCIATES, LAFAYETTE, CA.
Mathematical Modeling of Surface Water Impoundments, Volume: I, and II,
W79-05011 2H

RICE UNIV., HOUSTON, TX. DEPT. OF ENVIRONMENTAL ENGINEERING.
Drainage Density at Index of Watershed Development,
W79-05034 4A

ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE, MIAMI, FL.
Reactions in Chlorinated Seawater,
W79-05450 5A

ROYAL SOCIETY FOR THE PROTECTION OF BIRDS SANDY (ENGLAND).
Birds Oiled During the Amoco Cadiz Incident - An Interim Report,
W79-05192 5B

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. DEPT. OF SOILS AND CROPS.
Better Grasses for Roadsides,
W79-05238 6G

SASKATCHEWAN UNIV., SASKATOON. DIV. OF HYDROLOGY.
Melting of a Prairie Snowpack,
W79-05252 2C

SCHOOL OF MINES RESEARCH AND DEVELOPMENT ASSOCIATION, RAPID CITY, SD.
Investigation of the Availability of Geothermal Energy for the Demineralization of Saline Water,
W79-05367 3A

SCIENCE AND EDUCATION ADMINISTRATION, AMES, IA. NORTH CENTRAL REGION.
Sedimentation Modeling of Impoundment Terraces,
W79-05039 2J

SCIENCE AND EDUCATION ADMINISTRATION, BATON ROUGE, LA.
Subsurface Drainage of an Alluvial Clay Soil for Soybeans,
W79-05053 4B

SCIENCE AND EDUCATION ADMINISTRATION, BOISE, ID. NORTHWEST WATERSHED RESEARCH CENTER.
Sediment Characteristics and Transport from Northwest Rangeland Watersheds,
W79-05035 2J

Reducing Stream Sediment Loads by Irrigation Diversions,
W79-05057 2J

SCIENCE AND EDUCATION ADMINISTRATION, COLUMBIA, MO. NORTH CENTRAL WATERSHED RESEARCH CENTER.
Land Use Effects on Claypan Soil Hydrology,
W79-05063 4A

SCIENCE AND EDUCATION ADMINISTRATION, FORT COLLINS, CD.
Electrical Load and Water Management,
W79-05290 3F

SCIENCE AND EDUCATION ADMINISTRATION, MANDAN, MD. NORTHERN GREAT PLAINS RESEARCH CENTER.
Laterally Confined Flow from a Point Source at the Surface of an Inhomogeneous Soil Column,
W79-05261 2G

SCIENCE AND EDUCATION ADMINISTRATION, MORRIS, MN. NORTH CENTRAL SOIL CONSERVATION RESEARCH CENTER.
Characterization of Rill and Interrill Eroded Soil,
W79-05040 2J

SCIENCE AND EDUCATION ADMINISTRATION, OXFORD, MS.
Sea Research Program for Channel Stability and Gully Control,
W79-05068 2J

SCIENCE AND EDUCATION ADMINISTRATION, OXFORD, MS. SEDIMENTATION LAB.
Erosion Simulation for Land Use Management,
W79-05055 2J

SCIENCE AND EDUCATION ADMINISTRATION, TEMPLE, TX. GRASSLAND, SOIL AND WATER RESEARCH LAB.
Influence of Row Spacing of Grain Sorghum on Ground Cover, Runoff, and Erosion,
W79-05258 3F

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CA.
Pigment Composition, Photosynthesis and Fine Structure of a Non-Blue-Green Prokaryotic Algal Symbiont (Prochloron Sp.) in a Didemnid Ascidian from Hawaiian Waters,
W79-05324 5C

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CA. PHYSIOLOGICAL RESEARCH LAB.
The Effects of Oil on Temperature Regulation in Sea Otters,
W79-05214 5C

SENNINGER IRRIGATION, INC., ORLANDO, FL. (ASSIGNEE).
Spray Nozzle,
W79-05374 3F

SHEAFFER AND ROLAND, INC., CHICAGO, IL.
Land Application of Waste--Important Alternative,
W79-05032 5E

SHELL CHEMICAL CO., HOUSTON, TX.
Energy and Irrigation,
W79-05288 3F

SINGAPORE UNIV.
The Use of Landsat Imagery for Marine Pollution Studies,
W79-05396 7B

SKIDAWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.
Stability and Composition of Terrestrially Derived Dissolved Organic Nitrogen in Continental Shelf Surface Waters,
W79-05355 5C

SOIL CONSERVATION SERVICE, COLLEGE PARK, MD.
Flood Hazard Analyses: Little Catoctin Creek and Tributaries, Frederick County, Maryland.
W79-05246 2E

SOLAR WIND SYSTEMS, INC., SAN RAFAEL, CA.
Solid State Control Systems for Irrigation,
W79-05289 3F

SOUTH CAROLINA UNIV., COLUMBIA. DEPT. OF GEOLOGY.
Coastal Morphology, Oil Spill Vulnerability and Sedimentology of Kotzebue Sound and Kodiak Island,
W79-05213 5C

SOUTHERN CALIFORNIA COASTAL WATER RESEARCH PROJECT, EL SEGUNDO.
Trace Metal Contamination of the Rock Scallop, Hinnites Giganteus, Near a Large Southern California Municipal Outfall,
W79-05096 5B

DDT, PCB and Chlorinated Benzenes in the Marine Ecosystem Off Southern California,
W79-05455 5C

SOUTHERN PIEDMONT CONSERVATION RESEARCH CENTER, WATKINSVILLE, GA.
Soil Erosion and Sediment Movement Under Sugarcane Culture on the Flat Lands of Southern Louisiana,
W79-05038 2J

SRI INTERNATIONAL MENLO PARK, CA.
Environmental Pathways of Selected Chemicals in Freshwater Systems Part II: Laboratory Studies,
W79-05198 5A

Systems for Rapid Ranking of Environmental Pollutants. Selection of Subjects for Scientific and Technical Assessment Reports,
W79-05286 5A

The Mutagenic Activity of Halogenated Compounds Found in Chlorinated Drinking Water,
W79-05467 5C

STANFORD RESEARCH INST., MENLO PARK, CA.
Cost Analysis of Six Water Desalting Processes,
W79-05074 3A

STATE UNIV. OF NEW YORK COLL. AT PLATTSBURGH. DEPT. OF COMPUTER SCIENCE.
Feasibility Study on Executive Program Development for Basin Ecosystem Modeling,
W79-05285 5G

STATION BIOLOGIQUE DE ROSCOFF (FRANCE).
Preliminary Observations on Pollution of the Sea Bed and Disturbance of Sub-Littoral Communities in Northern Brittany by Oil from the Amoco Cadiz,
W79-05194 5B

STEARNS-ROGER CORP., DENVER, CO.
Third Annual Report: Saline Water Conversion Demonstration Plant No. 1, Freeport, Texas.
W79-05082 3A

STIRLING UNIV. (SCOTLAND). DEPT. OF BIOLOGY.
Community Production and Respiration by Ciliated Protozoa in the Benthos of a Small Eutrophic Loch,
W79-05354 5C

STOCKHOLD UNIV. (SWEDEN). INST. OF BOTANY.
Productivity Studies on Baltic Macroalgae,
W79-05347 5C

SYRACUSE UNIV., RESEARCH CORP., NY.
Further Properties of Hydrates and Hydrating Agents.
W79-05089 3A

TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS). LAB. OF GENERAL AND TECHNICAL BIOLOGY.
A Mercury Buffer for Toxicity Experiments with Green Algae,
W79-05210 5A

TECHNISCHE UNIV., DARMSTADT (GERMANY, F.R.).
The German Federal Law on Wastewater Charges,
W79-05315 6E

TEMPLE UNIV., PHILADELPHIA, PA. DEPT. OF ECONOMICS.
Endogenous Bias in Technical Progress and Environmental Policy,
W79-05319 6B

TENNESSEE TECHNOLOGICAL UNIV., COOKEVILLE. DEPT. OF CIVIL ENGINEERING.
Development of a Rapid Tissue Bioassay Technique for Screening Pollutant Effects on Fish,
W79-05229 5A

TENNESSEE UNIV., KNOXVILLE. DEPT. OF CIVIL ENGINEERING.
Evaluation of the Effects of Urbanization on Stormwater Runoff and Quality,
W79-05400 4C

TETRA TECH, INC. LAFAYETTE, CA.
Respiratory and Osmoregulatory Responses of White Perch (Morone Americana) Exposed to Chlorine and Ozone in Estuarine Waters,
W79-05461 5C

TEXAS A AND M RESEARCH FOUNDATION, COLLEGE STATION.
Development of the Solvent Demineralization of Saline Water,
W79-05370 3A

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY.
The Economic Value of Irrigation Water in the Western United States: An Application of Ridge Regression,
W79-05399 6B

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF AGRICULTURAL ENGINEERING.
Pressure Losses Across Trickle Irrigation Fittings and Emitters,
W79-05060 8B

TEXAS CHRISTIAN UNIV., FORT WORTH. DEPT. OF GEOLOGY.
Prediction of Soil Loss on Cropland with Remote Sensing,
W79-05148 7B

TEXAS DEPT. OF WATER RESOURCES, AUSTIN.
The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume I.
W79-05014 2F

The Seymour Aquifer Ground-Water Quality and Availability in Haskell and Knox Counties, Texas, Volume II.
W79-05015 7C

TEXAS PARKS AND WILDLIFE DEPT., INGRAM. HEART OF HILLS FISHERIES RESEARCH STATION.
Palaemonid Shrimp, Macrobrachium Amazonicum: Effects of Salinity and Temperature on Survival,
W79-05181 5B

TEXAS UNIV. AT AUSTIN. DEPT. OF MICROBIOLOGY.
Microbial Degradation of Halogenated Hydrocarbons,
W79-05454 5A

TEXAS UNIV. HEALTH SCIENCE CENTER AT HOUSTON. SCHOOL OF PUBLIC HEALTH.
Trophic Level Accumulation of Heavy Metals in a Coal Ash Basin Drainage System,
W79-05108 5A

TOKYO INST. OF TECH. (JAPAN). DEPT. OF ENVIRONMENTAL CHEMISTRY.
Calcite as a Source of Excess Calcium in Rainwater,
W79-05262 2K

TORONTO UNIV. (ONTARIO). DEPT. OF BOTANY.
Comparison of Algae in Euplankton, Tychoplankton, and Periphyton of a Tundra Pond,
W79-05329 5C

TORRY RESEARCH STATION, ABERDEEN (SCOTLAND).
Early Samples of Oil in Water and Some Analyses of Zooplankton,
W79-05186 5A

TOULOUSE-3 UNIV. (FRANCE). LAB. D'HYDROBIOLOGIE.
Changes in the Species Composition of Fish in the River Lot,
W79-05184 5B

The Riou-Mort a Tributary to the River Lot Polluted by Heavy Metals. I. Preliminary Observations on the Chemistry and Benthic Algae,
W79-05206 5B

TSELINOGRAD AGRICULTURAL INST. (USSR).
Application of Straw in Agriculture in the Arid Steppe Zone of the Northern Kazakh SSR (In Russian),
W79-05343 2G

UNIVERSITE DE BRETAGNE-OCCIDENTALE, BREST (FRANCE). INST. D'ETUDES MARINE.
The Ecological Impact on and Near Shores by the Amoco Cadiz Oil Spill,
W79-05190 5B

UNIVERSITE DE BRETAGNE-OCCIDENTALE, BREST (FRANCE). LAB. DE PHYSIOLOGIE VEGETALE.
Preliminary Results Concerning Effects of Chlorine on Monospecific Marine Phytoplankton,
W79-05093 5B

UNIVERSITY COLL., GALWAY (IRELAND).
The Growth and Decay of a Hydraulic Jump,
W79-05146 8B

UNIVERSITY OF STRATHCLYDE, GLASGLOW (SCOTLAND). DEPT. OF BIOLOGY.
The Uptake, Translocation and Metabolism of Dichlobenil in Selected Aquatic Species,
W79-05331 5C

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA). HYDROLOGICAL RESEARCH UNIT.
Trends in Streamflow Due to Upstream Land-Use Changes,
W79-05147 2E

UNIVERSITY OF WEST FLORIDA, PENSACOLA. FACULTY OF BIOLOGY.
Dissolved Glucose in a Bayou Estuary, Possible Sources and Utilization by Bacteria,
W79-05397 5C

UTAH STATE UNIV., LOGAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Trickle Irrigation Tubing Hydraulics,
W79-05061 8B

UTAH STATE UNIV., LOGAN. DEPT. OF FORESTRY AND OUTDOOR RECREATION.
Runoff Curve Numbers with Varying Site Moisture,
W79-05023 2D

UTAH WATER RESEARCH LAB., LOGAN; AND UTAH CENTER FOR WATER RESOURCES RESEARCH, LOGAN.
Integrating Water Resources and Land Use Planning,
W79-05408 6B

'IRGINIA INST. OF MARINE SCIENCE, ;LOUCESTER POINT.
Effects of Chlorinated Sea Water on Decapod Crustaceans,
W79-05459 5C

/IRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF BIOLOGY.
Influence of Chlorine Form and Ambient Temperature on the Toxicity of Intermittent Chlorination to Freshwater Fish,
W79-05445 5C

Development of Resistant Poliovirus by Repetitive Sublethal Exposure to Chlorine,
W79-05470 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF BIOLOGY; AND VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. CENTER FOR ENVIRONMENTAL STUDIES.
The Use of Various Avoidance Indices to Evaluate the Behavioral Response of the Golden Shiner to Components of Total Residual Chlorine,
W79-05446 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.
Chlorination and Water Treatment for Minimizing Trihalomethanes in Drinking Water,
W79-05474 5C

VIRGINIA STATE WATER CONTROL BOARD, ROANOKE. WEST CENTRAL REGIONAL OFFICE.
State Ground-Water Protection Programs--Inadequate,
W79-05131 5G

VIRGINIA STATE WATER CONTROL BOARD, VIRGINIA BEACH. TIDEWATER REGIONAL OFFICE.
Bromine Chloride as an Alternative Wastewater Disinfectant to Chlorine,
W79-05484 5C

VIRGINIA UNIV., CHARLOTTESVILLE.
Collective Decision Making in Water Resource Planning,
W79-05274 6A

VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF ENVIRONMENTAL SCIENCES.
Some Aspects of Florida Convective Rainfall,
W79-05139 2B

VIZGAZDALKODASI TUDOMANYOS KUTATO INTEZET, BUDAPEST (HUNGARY).
Mixing Model for Large Streams,
W79-05133 5B

VSESOYUZNYI-NAUCHNYI PLANOVII OTDEL BUMAZHNOI PROMYSHLENNOST, MOSCOW (USSR).
Highly Effective Paper-Machine Shower Systems (Vysoko-effektinye Spryskovye Sistemy),
W79-05430 3E

VYSOKA SKOLA VETERINARNI BRNO (CZECHOSLAVAKIA).
Histopathological Changes in the Fish After Intoxication with Non-Ionogenic Tensides on the Basis of Ethoxyl Aducts of Isononylphenols (Histopatologicke Zmeny u Ryb Po Intoxikaci Neionogennimi Tenzidy na Bazi Ethoxylovych Aduktu Isononylfenolu),
W79-05099 5C

WAHLER (W. A.) AND ASSOCIATES, PALO ALTO, CA.
Review of Design, Construction, and Operation of Soldier Creek Dam Project, Utah.
W79-05239 8A

Review of Design, Construction, and Operation of Mountain Park Dam Project, Oklahoma,
W79-05240 8A

Review of Design, Construction, and Operation of Mt. Elbert Forebay Dam and Reservoir Project, Colorado,
W79-05241 8A

Review of Design, Construction, and Operation of Crystal Dam Project, Colorado,
W79-05242 8A

Review of Design, Construction, and Operation of Pueblo Dam Project, Colorado,
W79-05243 8A

Review of Design, Construction, and Operation of Ririe Dam Project, Idaho,
W79-05244 8A

Review of Design, Construction, and Operation of Nambe Falls Dam Project, New Mexico.
W79-05247 8A

WAPORA, INC. WASHINGTON, DC.
Avoidance of Monochloramine: Test Tank Results for Rainbow Trout, Coho Salmon, Alewife, Yellow Perch and Spottail Shiner,
W79-05447 5C

WARMWATER FISH HATCHERY (HUNGARY).
The Use of Copperoxychloride During Larval Growth as a Preventative Measure Against the Spread of Ciliata-Exoparasites,
W79-05209 5B

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF GEOLOGY.
Hydrogeology of Bermuda--Significance of an Across-the-Island Variation in Permeability,
W79-05031 2L

WASHINGTON UNIV., SEATTLE. COLL. OF FISHERIES.
The Lake Washington Ecosystem: The Perspective from the Fish Community Production and Forage Base,
W79-05103 5C

Hatching Table for Fisheries Research,
W79-05178 5A

WASHINGTON UNIV., SEATTLE. ENGINEERING EXPERIMENT STATION.
Research and Development of Processes for Desalting Water by Freezing,
W79-05085 3A

WASHINGTON UNIVERSITY, SEATTLE. DEPT. OF OCEANOGRAPHY.
The Interaction of Oil with Sea Ice,
W79-05217 5C

WATER RESEARCH CENTER, MEDMENHAM (ENGLAND). MEDMENHAM LAB.
Sludge to Land--Economic Considerations for Water Authorities,
W79-05320 6B

WATER-TRONICS, INC., CHARLOTTE, NC. (ASSIGNEE).
Ionization Chamber for Water Treatment System,
W79-05384 5F

WATERLOO UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Behaviour of a Hydrodynamic Finite Element Model,
W79-05020 8B

WEHRAN ENGINEERING CORP., MIDDLETOWN, NY.
The Federal Ground-Water Protection Program--Tomorrow's Undoing,
W79-05129 5G

WEST SIDE PUMP CO., LOS PALOS, CA.
Practical Surface Irrigation,
W79-05306 3F

WISCONSIN UNIV.-MILWAUKEE. CENTER FOR GREAT LAKES STUDIES; AND WISCONSIN UNIV.-MILWAUKEE. DEPT. OF ZOOLOGY.
A Preliminary Look at the Effects of Intermittent Chlorination on Selected Warmwater Fishes,
W79-05443 5C

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA.
Data File: New Bedford Harbor, Massachusetts,
W79-05249 2L

The Anatomy of the Antarctic Polar Front in the Drake Passage,
W79-05265 2L

Biological and Chemical Effects of Chlorination at Coastal Power Plants,
W79-05456 5C

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA. DEPT. OF OCEAN ENGINEERING.
Acoustic Monitoring of Industrial Chemical Waste Release at Deep Water Dump Site 106,
W79-05264 5B

WOODWARD-CLYDE CONSULTANTS, SAN FRANCISCO, CA.
Evaluation of Proposed Storage Sites,
W79-05277 6B

WORLD HEALTH ORGANIZATION, GENEVA (SWITZERLAND). DIV. OF ENVIRONMENTAL HEALTH.
Worldwide Aspects of Water Chlorination, W79-05472 5C

WRIGHT-MCLAUGHLIN ENGINEERS, DENVER, CO.
Land Application of Waste--State of the Art, W79-05033 5E

ACCESSION NUMBER INDEX

W79-05001 5C
W79-05002 5E
W79-05003 5A
W79-05004 5A
W79-05005 5C
W79-05006 5D
W79-05007 5C
W79-05008 2L
W79-05009 5D
W79-05010 6B
W79-05011 2H
W79-05012 5A
W79-05013 2B
W79-05014 2F
W79-05015 7C
W79-05016 2J
W79-05017 2E
W79-05018 2A
W79-05019 5B
W79-05020 8B
W79-05021 5B
W79-05022 2L
W79-05023 2D
W79-05024 2E
W79-05025 2F
W79-05026 2F
W79-05027 2F
W79-05028 2F
W79-05029 2H
W79-05030 2A
W79-05031 2L
W79-05032 5E
W79-05033 5E
W79-05034 4A
W79-05035 2J
W79-05036 5B
W79-05037 2G
W79-05038 2J
W79-05039 2J
W79-05040 2J
W79-05041 5B
W79-05042 5B
W79-05043 5B
W79-05044 5A
W79-05045 3A
W79-05046 5F
W79-05047 5D
W79-05048 5D
W79-05049 6E
W79-05050 5B
W79-05051 2G
W79-05052 6A
W79-05053 4B
W79-05054 2G
W79-05055 2J
W79-05056 5G
W79-05057 2J
W79-05058 2J
W79-05059 4A
W79-05060 8B
W79-05061 8B
W79-05062 8B
W79-05063 4A
W79-05064 2G
W79-05065 5B
W79-05066 2J
W79-05067 2G
W79-05068 2J
W79-05069 2G
W79-05070 3A
W79-05071 3A
W79-05072 3A
W79-05073 3A
W79-05074 3A
W79-05075 3A
W79-05076 3A
W79-05077 3A
W79-05078 3A
W79-05079 3A
W79-05080 3A
W79-05081 3A
W79-05082 3A
W79-05083 3A
W79-05084 3A
W79-05085 3A
W79-05086 3A
W79-05087 3A
W79-05088 3A
W79-05089 3A
W79-05090 5B
W79-05091 2E
W79-05092 6A
W79-05093 5B
W79-05094 5B
W79-05095 5B
W79-05096 5B
W79-05097 5C
W79-05098 5C
W79-05099 5C
W79-05100 5C
W79-05101 5C
W79-05102 5C
W79-05103 5C
W79-05104 5C
W79-05105 5A
W79-05106 5A
W79-05107 5A
W79-05108 5A
W79-05109 5A
W79-05110 5A
W79-05111 5A
W79-05112 5A
W79-05113 5C
W79-05114 5A
W79-05115 5C
W79-05116 5B
W79-05117 5A
W79-05118 2E
W79-05119 7B
W79-05120 5C
W79-05121 5C
W79-05122 5B
W79-05123 5B
W79-05124 5B
W79-05125 5B
W79-05126 5B
W79-05127 5G
W79-05128 5G
W79-05129 5G
W79-05130 5G
W79-05131 5G
W79-05132 5G
W79-05133 5B
W79-05134 2L
W79-05135 2J
W79-05136 2G
W79-05137 2G
W79-05138 2C
W79-05139 2B
W79-05140 2C
W79-05141 2E
W79-05142 2J
W79-05143 2F
W79-05144 5B
W79-05145 2H
W79-05146 8B
W79-05147 2E
W79-05148 7B
W79-05149 2J
W79-05150 2F
W79-05151 4B
W79-05152 7C
W79-05153 2F
W79-05154 2F
W79-05155 5B
W79-05156 5B
W79-05157 5B
W79-05158 6A
W79-05159 7A
W79-05160 7C
W79-05161 4B
W79-05162 7C
W79-05163 7B
W79-05164 2F
W79-05165 7C
W79-05166 2E
W79-05167 7C
W79-05168 2H
W79-05169 4B
W79-05170 4D
W79-05171 5B
W79-05172 2J
W79-05173 1A
W79-05174 5C
W79-05175 5A
W79-05176 5C
W79-05177 5C
W79-05178 5A
W79-05179 5B
W79-05180 5A
W79-05181 5B
W79-05182 5A
W79-05183 5B
W79-05184 5B
W79-05185 5A
W79-05186 5A
W79-05187 5C
W79-05188 5A
W79-05189 5A
W79-05190 5B
W79-05191 5B
W79-05192 5B
W79-05193 5B
W79-05194 5B
W79-05195 5C
W79-05196 5A
W79-05197 5B
W79-05198 5A
W79-05199 5B
W79-05200 5B
W79-05201 5A
W79-05202 5C
W79-05203 5C
W79-05204 5C
W79-05205 5A
W79-05206 5B
W79-05207 5C
W79-05208 5A
W79-05209 5B
W79-05210 5A
W79-05211 5A
W79-05212 5C
W79-05213 5C
W79-05214 5C
W79-05215 5C
W79-05216 5C
W79-05217 5C
W79-05218 5C
W79-05219 5C
W79-05220 5C
W79-05221 5C
W79-05222 5C
W79-05223 5C
W79-05224 5C
W79-05225 2A
W79-05226 2K
W79-05227 5B
W79-05228 5B
W79-05229 5A
W79-05230 5B
W79-05231 5C
W79-05232 6F
W79-05233 2E
W79-05234 5C
W79-05235 6G
W79-05236 6G
W79-05237 4D
W79-05238 6G
W79-05239 8A
W79-05240 8A
W79-05241 8A
W79-05242 8A
W79-05243 8A
W79-05244 8A
W79-05245 5B
W79-05246 2E
W79-05247 8A
W79-05248 8A
W79-05249 2L
W79-05250 2H
W79-05251 2G
W79-05252 2C
W79-05253 2H
W79-05254 2J
W79-05255 8B
W79-05256 2E
W79-05257 2G
W79-05258 3F
W79-05259 2J
W79-05260 2C
W79-05261 2G
W79-05262 2K
W79-05263 2H
W79-05264 5B
W79-05265 2L
W79-05266 2L
W79-05267 2L
W79-05268 2L
W79-05269 5C
W79-05270 5G
W79-05271 4B
W79-05272 6F
W79-05273 6A
W79-05274 6A
W79-05275 3F
W79-05276 6C
W79-05277 6B
W79-05278 2C
W79-05279 2C
W79-05280 2A
W79-05281 7C
W79-05282 2A
W79-05283 2H
W79-05284 2I
W79-05285 5G
W79-05286 5A
W79-05287 3F
W79-05288 3F
W79-05289 3F
W79-05290 3F
W79-05291 3F
W79-05292 3F
W79-05293 3F
W79-05294 3F
W79-05295 3F
W79-05296 3F
W79-05297 3F
W79-05298 3F
W79-05299 3F
W79-05300 3F
W79-05301 3F
W79-05302 3F
W79-05303 3F
W79-05304 3F
W79-05305 3F
W79-05306 3F
W79-05307 3F
W79-05308 3F
W79-05309 3F
W79-05310 3F
W79-05311 3F
W79-05312 3F
W79-05313 3F
W79-05314 2I
W79-05315 6E
W79-05316 6B
W79-05317 6C
W79-05318 6B
W79-05319 6B
W79-05320 6B
W79-05321 2I
W79-05322 5C
W79-05323 5C
W79-05324 5C
W79-05325 5C
W79-05326 5C
W79-05327 2I
W79-05328 5C
W79-05329 5C
W79-05330 5C
W79-05331 5C
W79-05332 5C

W79-05333	5C
W79-05334	5C
W79-05335	5C
W79-05336	2I
W79-05337	5C
W79-05338	5C
W79-05339	5G
W79-05340	5C
W79-05341	5C
W79-05342	2I
W79-05343	2G
W79-05344	5B
W79-05345	5C
W79-05346	5C
W79-05347	5C
W79-05348	6G
W79-05349	5C
W79-05350	5C
W79-05351	5C
W79-05352	5C
W79-05353	5C
W79-05354	5C
W79-05355	5C
W79-05356	5C
W79-05357	3A
W79-05358	3A
W79-05359	3A
W79-05360	3A
W79-05361	3A
W79-05362	3A
W79-05363	3A
W79-05364	3A
W79-05365	3A
W79-05366	3A
W79-05367	3A
W79-05368	3A
W79-05369	3A
W79-05370	3A
W79-05371	3A
W79-05372	5D
W79-05373	3F
W79-05374	3F
W79-05375	3F
W79-05376	5G
W79-05377	5D
W79-05378	5G
W79-05379	3F
W79-05380	5G
W79-05381	5D
W79-05382	2I
W79-05383	5D
W79-05384	5F
W79-05385	5D
W79-05386	5D
W79-05387	3F
W79-05388	4A
W79-05389	3F
W79-05390	5G
W79-05391	5F
W79-05392	7B
W79-05393	7B
W79-05394	7B
W79-05395	7B
W79-05396	7B
W79-05397	5C
W79-05398	5C
W79-05399	6B
W79-05400	4C
W79-05401	9D
W79-05402	6B
W79-05403	6B
W79-05404	6B
W79-05405	6B
W79-05406	6B
W79-05407	6B
W79-05408	6B
W79-05409	10D
W79-05410	10D
W79-05411	6A
W79-05412	5B
W79-05413	6D
W79-05414	6B
W79-05415	6E
W79-05416	5D
W79-05417	5D
W79-05418	5D
W79-05419	5D
W79-05420	5D
W79-05421	3E
W79-05422	3E
W79-05423	3E
W79-05424	5D
W79-05425	5D
W79-05426	5C
W79-05427	6D
W79-05428	5C
W79-05429	5C
W79-05430	3E
W79-05431	5D
W79-05432	5A
W79-05433	3E
W79-05434	5A
W79-05435	5C
W79-05436	5A
W79-05437	5C
W79-05438	5A
W79-05439	5A
W79-05440	5A
W79-05441	5C
W79-05442	5C
W79-05443	5C
W79-05444	5C
W79-05445	5C
W79-05446	5C
W79-05447	5C
W79-05448	5C
W79-05449	5C
W79-05450	5A
W79-05451	5A
W79-05452	5A
W79-05453	5A
W79-05454	5A
W79-05455	5C
W79-05456	5C
W79-05457	5C
W79-05458	5C
W79-05459	5C
W79-05460	5C
W79-05461	5C
W79-05462	5C
W79-05463	5C
W79-05464	5C
W79-05465	5C
W79-05466	5C
W79-05467	5C
W79-05468	5C
W79-05469	5C
W79-05470	5C
W79-05471	5C
W79-05472	5C
W79-05473	5C
W79-05474	5C
W79-05475	5C
W79-05476	5A
W79-05477	5C
W79-05478	5C
W79-05479	5C
W79-05480	5C
W79-05481	5C
W79-05482	5C
W79-05483	5C
W79-05484	5C
W79-05485	5C
W79-05486	5C
W79-05487	5C
W79-05488	5D
W79-05489	5C
W79-05490	5A
W79-05491	5C
W79-05492	5C
W79-05493	5C
W79-05494	5C
W79-05495	5C
W79-05496	5B
W79-05497	3E
W79-05498	3C
W79-05499	5F
W79-05500	5A

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Colorado State University Irrigation Return Flow Quality	W79-05051--05069 05287--05313	46
Cornell University, Policy Models for Water Resources Systems	W79-05010 05269--05283 05285--05286 05410--05413	22
DOE Oak Ridge National Laboratory, Nuclear Radiation and Safety	W79-05435--05489 05491--05495	60
Illinois State Water Survey Hydrology	W79-05012--05043 05119--05148 05235--05268	96
Institute of Paper Chem., Water Pollution from Pulp and Paper Industry	W79-05416--05427 05430--05434 05496--05500	22
University of Wisconsin, Eutrophication	W79-05231 05322--05326 05328--05335 05337--05341 05344--05347 05349--05356 05428--05429 05490	34
University of Wisconsin, Water Resources Economics	W79-05315--05320	6
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-05001--05009 05046--05050 05090--05092 05225 05227--05230 05233--05234 05397--05400 05415	29

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER		
BioSciences Information Service	W79-05226, 05284 05314, 05321 05327, 05336 05342--05343 05348, 05382	10
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-05093--05114 05174--05211	60
Forest Service (USDA)	W79-05044	1
Information Planning Associates, Inc.	W79-05070--05089 05357--05371	35
National Oceanic and Atmospheric Administration	W79-05115--05118	4
Ocean Engineering Infor. Service (Outer Continental Shelf)	W79-05212--05224 05392--05396	18
Ocean Engineering Infor. Service (Patents)	W79-05372--05381 05383--05391	19
Office of Water Research and Technology	W79-05011, 05045 05232 05401--05409 05414	13
U.S. Geological Survey	W79-05149--05173	25

☆U.S. GOVERNMENT PRINTING OFFICE: 1979-281-061/23

CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Illinois State Water Survey.

- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

Supported by the Environmental Protection Agency in cooperation with WRSIC

- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
- WATER RESOURCES PLANNING
- RESOURCES DATA
- ENGINEERING WORKS
- MANPOWER, GRANTS, AND FACILITIES
- SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSION NUMBER INDEX
- ABSTRACT SOURCES

U.S. MAIL

POSTAGE AND FEES PAID
U S DEPARTMENT OF COMMERCE
COM 211

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OFFICIAL BUSINESS

PRINTED MATTER

AN EQUAL OPPORTUNITY EMPLOYER

Dr. Ben Ewing
408 S. Goodwin
Urbana, IL 61801

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, U.S., and Mexico please use this price schedule; other addressees write for Folder PR-360-4.

A01	$3.00	E01	$3.25	T01	$110.00
A02	4.00	E02	4.75	T02	125.00
A03	4.50	E03	6.25	T03	175.00
A04	5.25	E04	7.50	T04	250.00
A05	6.00	E05	9.00	T05	300.00
A06	6.50	E06	10.50	T06	350.00
A07	7.25	E07	12.50	T07	400.00
A08	8.00	E08	15.00	T08	450.00
A09	9.00	E09	17.50	T09	500.00
A10	9.25	E10	20.00	T10	550.00
A11	9.50	E11	22.50	T11	600.00
A12	10.75	E12	25.00	T12	650.00
A13	11.00	E13	28.00	T13	675.00
A14	11.75	E14	31.00	T14	750.00
A15	12.00	E15	34.00	T15	800.00
A16	12.50	E16	37.00	T16	850.00
A17	13.00	E17	40.00	T17	900.00
A18	13.25	E18	45.00	T18	950.00
A19	14.00	E19	50.00	T19	1,000.00
A20	14.50	E20	60.00	T99	*
A21	15.00	E99	*		
A22	15.25				
A23	15.50	N01	28.00		
A24	16.25	N02	50.00		
A25	16.50				
A99	*				

*Contact NTIS for price quote

.55291
8
4

The Library of the
AUG 2 1979
University of Illinois
at Urbana Champaign

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 12
JUNE 15, 1979

W79-05501--W79-06000
CODEN:SWRABW

SELECTED WATER RESOURCES ABSTRACTS is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce, for the Water Resources Scientific Information Center (WRSIC).

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Manager, Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior, Washington, DC 20240.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is attached to the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are: SWRA Journal only, $75; Journal and Annual Indexes, $100; Indexes only, $50. Other addressees, write for prices.

SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 12
JUNE 15, 1979

W79-05501--W79-06000

e Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the ansaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

THE STUDY OF IONIC SOLVATION,
Pennsylvania Univ., Philadelphia.
J. O'M. Bockris, P. P. S. Saluja, and G. Madan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 591, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 569, June 1970. 161 p, 56 fig, 43 tab, 24 ref. 14-01-0001-1467.

Descriptors: *Water structure, *Water properties, *Electrolytes, *Solvation, Mechanical properties, Compressibility, Water analysis, Ultrasonics, Hydration, Anions, Cations, Physical properties, Mathematical models, Aqueous solutions, Water chemistry, Desalination.

The ionic hydration aspects of the structure of aqueous electrolytic solutions were studied with regard to the method of determining the individual hydration number of cation and anion in the electrolyte solution. Two experimental methods were used in this approach to gather enough data on these hydration numbers, so that a theory on them could be formulated and the physical meaning of the concept could be clarified. The compressibility method is based on measuring the velocity of propagation of ultrasonic waves through the solution. The measurements give the compressibilities of the solution which are used to calculate the sum of the solvation numbers of the ions in the solution. The ionic vibration potential method is based on the electrical effects associated with the propagation of ultrasonic waves through solution. When a solution is subjected to ultrasonic vibration it develops a potential difference proportional to the difference of the effective masses of the cation and the anion. The potential difference is used to calculate the difference of mass of the water attached to the ion and, therefore, the solvation number of cation and anion in the electrolytic solution. A model developed for electrostriction gives good agreement between the calculated and experimental electrostriction due to the individual ions. (Davison-IPA)
W79-05658

NEW YORK BIGHT WATER STRATIFICATION--OCTOBER 1974,
Lamont-Doherty Geological Observatory, Palisades, NY.
A. L. Gordon, A. F. Amos, and R. D. Gerard.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.). American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 45-57, 1976. 10 fig, 24 ref. Allen Press Inc., Lawrence, Kansas. Also as: Lamont-Doherty Geological Observatory Contribution 2402. ERDA-AT(11-1)2185.

Descriptors: *Baseline studies, *Stratification, *Water properties, Thermocline, *Outer Continental Shelf, *New York Bight, Thermohaline stratification, Pycnocline.

Thermohaline stratification of New York Bight continental shelf water during October 1974 is basically of the summer regime. Salinity increases markedly with increased distance from the coast, yet a basic vertical structure is maintained: an upper isohaline layer; a salinity maximum at the top of the thermocline; a salinity minimum at the base of the thermocline; a deep isohaline layer associated with the cold near-bottom winter residual stratum; and (over the outer shelf) a bottom intrusion of relatively saline and warm slope water. Inversions in temperature are common within the thermocline. The pycnocline is continuous over the shelf and slope, though some weakening and deepening occurs over the shelf break. Over the shelf it is mainly supported by the thermocline and over the slope by the halocline. The pycnocline may not be an effective barrier to isopycnal interchange of surface and deep layers in view of the relative slope of isopycnals to pycnocline. In October 1974 oxygen distribution of the continental shelf was primarily two-layered, with a sharp division at the pycnocline. The lower cold layer has an oxygen concentration of near 60% of full saturation, with values near 3.6 ml/liter. This is low; if the deeper layer is principally a residue of the winter homogeneous condition with initial saturated oxygen values, it would represent oxygen consumption at a rate of 2.6 ml/liter during the six summer months after accounting for the low oxygen influx of slope water. (Sinha-OEIS)
W79-05682

DISTRIBUTION OF HYDROGRAPHIC PROPERTIES IN THE NEW YORK BIGHT APEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
M. J. Bowman, and L. D. Wunderlich.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.). American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 58-68, 1976. 8 fig, 28 ref. Allen Press Inc., Lawrence, Kansas. Also as: State Univ. New York Marine Sciences Research Center Contribution 145.

Descriptors: *Baseline studies, *Hydrography, *Oceanography, *Water properties, Water pollution, Water quality, *Outer Continental Shelf, *New York Bight.

Seasonal hydrographic cycles are interpreted through a series of isometric block diagrams and planimetric projections illustrating the distributions of temperature, salinity, and density in the bight apex. Seasonal cycles are typical of those found in coastal seas near river mouths in drowned river valleys in temperate latitudes. The prevailing southwest coastal drift, the right-angle bend of the coastline, seasonal and short term wind patterns, and the presence of the Hudson Shelf Valley, all influence the nearshore circulation. (Sinha-OEIS)
W79-05683

2. WATER CYCLE

2A. General

HYDROLOGY AND WATER CONTROL ON LARGE PLAINS,
National Water Authority, Budapest (Hungary). Dept. of Water Resources Development.
G. Kovacs.
Hydrological Sciences Bulletin, Vol. 23, No. 3, p 305-332, September 1978. 27 fig, 4 ref.

Descriptors: *Water control, *Hydrology, *Depression storage, Infiltration, Runoff, Drainage, Land reclamation, Canals, Lakes, Geology, Groundwater, Evapotranspiration, Soil water, Soil moisture, Water balance. *Plains, *Hungary.

The hydrological processes developing in extensive plains differ considerably from those characterizing hilly and mountainous areas (sloping terrains in general). The surface of a plain has no slope at all, or the slopes are negligible and interrupted by local depressions. The runoff is extremely small compared to evaporation and infiltration, and the latter two balance the precipitation almost completely. The local depressions storing the precipitation temporarily as shallow pools form the basis of the hydrological network, instead of the sloping beds of rivers and streams. The excess water surpassing the storage capacity of the pools moves on the surface as sheet flow or erodes shallow channels. Since the difference in elevation between the various parts of the plain is relatively small, the potential maintaining the natural water movement on and below the surface may be modified considerably by human activities. The design of water control and land reclamation projects requires, therefore, very farseeing research. The local conditions give only limited information for this because the natural system may be basically different from that created artificially. Observational data from areas where water control projects have already been executed have a more important role when planning reclamation projects for large plains than in the case of the hydrological investigation of basins with some degree of slope. (Sims-ISWS)
W79-05526

RIVER RUNOFF REGULATION AND WATER-MANAGEMENT CALCULATIONS, (METODIKA REGULIROVANIYA STOKA I VODOKHOZYAISTVENNYKH RASCHETOV),
For primary bibliographic entry see Field 4A.
W79-05544

SOME RESULTS FROM URBAN RUNOFF STUDIES IN BERGSJON GOTEBORG,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Hydraulics.
V. Arnell, and S. Lyngfelt.
In: Geohydrological Research at the Chalmers University of Technology, Goteborg; Papers Presented at the Nordic Hydrological Conference in Reykjavik, August 29 to September 1, 1976, p 14-23, May 1977. 8 fig, 4 ref.

Descriptors: *Urban runoff, *Rainfall, *Model studies, *Mathematical models, Runoff, Drainage, Storage, Watersheds(Basins), Rainfall-runoff relationships, Sewers, Storms, Storm runoff, Infiltration, Hydrographs, Cities, Urban hydrology, Foreign research, *Sweden.

Urban runoff measurements carried out by the Department of Hydraulics, Chalmers University of Technology, were used to study such runoff characteristics as the relationship between rainfall and runoff volumes for separate storms. Runoff hydrographs simulated by a mathematical runoff model were compared with measured hydrographs. Experience in application resulted in improvement of the model; thus the accuracy of calculation was improved at the same time as the cost of simulations was cut down. (See also W79-05546) (Sims-ISWS)
W79-05548

AN OUTLINE OF SOIL, WATER AND AGRICULTURE IN ARAB COUNTRIES,
Alexandria Univ. (Egypt). Dept. of Soil Science.
A. Balba.
Journal of the Middle East, Vol. 2, p 59-82, 1975. 41 ref.

Descriptors: *Optimum development plans, *Surveys, *Data, *Institutional constraints, *Resources, *Data collection, Water resource planning, Geomorphology, Calcareous soils, Sands, Saline soils, Groundwater resources, Precipitation(Atmospheric), Surface waters, Economic feasibility.

The Arab world contains a variety of physiographic and climatic features that will require comprehensive and integrated surveys of the area's natural resources before development programs can succeed. This paper points out both the need for such inventories and the agricultural potential that could be realized when such resource information becomes available. The author discussed the properties, formation, and distribution of the predominately sandy, calcareous, and salt-affected soils as they are now known, as well as surface and groundwater resources of the area. Suitable crops for the prevailing conditions include cereals, cotton, fruit, and livestock feeds. Rainfall, streamflow, and underground water, and the agricultural development that can be supported by these resources are detailed together with an analysis of the need for trained manpower, capital investment, and integrated development projects. (Tickes-Arizona)
W79-05553

TWENTIETH-CENTURY SEMI-ARID CLIMATES AND CLIMATIC FLUCTUATIONS IN TEXAS AND NORTHEASTERN MEXICO,
Texas Instruments Inc., Dallas. Ecological Serv-

ices.
J. Norwine.
Journal of Arid Environment, Vol. 1, No. 4, p 313-325. December, 1978, 9 fig, 6 ref.

Descriptors: *Agroclimatology, *Weather data, *Climatic data, *Variability, *Hydrologic data, Cycles, Hydrologic cycle, Data collections, Meteorology, Depth-area-duration analysis, Droughts, Forecasting, Mexico, Texas, Semiarid climates.

South, central, and western Texas and northeastern Mexico are important food production areas suffering from dynamic unreliable climatic patterns. The climatology of this region is analyzed here for the implications of these climatic fluctuations for agriculture in the context of answers to such questions as: (1) has this semiarid region experienced any 20th century detectable cycles or climatic periodicities, (2) have significant long lasting trends occurred, and if so, of what nature and when, (3) could practical use of the answers to such questions be made. Data collected from 50 meteorological Texas stations and 40 northeastern Mexican stations were subsequently narrowed to that from 10 widely spaced stations in four subregions: the coastal plain of northeastern Mexico, south Texas, central Texas, and the north Texas High Plains, combined and averaged to provide mean, maximum, and minimum values. Although no regular periodicity of rainfall was found in the region, it was noted that droughts and wet spells, once begun, persisted for 10-30 year periods. The author believes that the best use to be made of such trends is to develop a set of recommended strategies to be adopted to best cope with eventualities as they began to take recognizable form. A drought alert, for instance, could be issued at the appropriate time, and strategies to cope could be enunciated, as is already being done in Australia. (Tickes-Arizona)
W79-05563

DRY CLIMATES--PAST AND PRESENT,
R. G. Barry.
Progress in Physical Geography, Vol. 2, No. 1, p 116-127, 1978. 1 fig, 1 tab, 74 ref.

Descriptors: *Climatology, *Weather patterns, *Paleoclimatology, *Circulation air, Atmospheric pressure, Climatic zones, Cloud physics, Fronts(Atmospheric), Hydrologic cycle, Meteorology, Topography.

A review of recent climatological research into dry climates is presented with emphasis upon possible mechanisms of change through time. For the purpose of this analysis four fundamental causes of aridity are assumed: (1) large-scale atmospheric subsidence associated with the descending arms of the tropical hadley cells, (2) local subsidence induced by topographic or other effects on the atmospheric circulation, (3) an absence of moist airstreams due to remoteness from moisture sources or a predominance of airflows from dry areas, and (4) an absence of weather systems that can induce precipitation of moisture in the air. Although it is now difficult to draw global generalizations about past climates in arid regions from available data, a clearer picture has recently begun to emerge. All such paleoclimatic considerations must take into account the fundamental principle that the maintenance of a global atmospheric circulation requires that on average there be subsiding air over the subtropics with high pressure cells. A brief review of recent paleoclimatic research of the arid regions based upon the principle of atmospheric circulation is presented while pointing out the essential requirement that critical events be firmly dated. It is concluded that a better understanding is required of the climatic factors which control the biological, hydrological and geological indicators of paleoclimatic conditions. (Tickes-Arizona)
W79-05570

HYDROLOGIC DATA FOR THE ANTLERS AQUIFER, SOUTHEASTERN OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
R. E. Davis, and D. L. Hart, Jr.
Geological Survey open-file report 78-1038, November 1978. 24 p, 5 tab, 3 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Well data, *Water quality, *Low flow, Streamflow, Water analysis, Chemical analysis, Water wells, Water yield, Water levels, Water utilization, *Antlers aquifer, *Southeastern Oklahoma.

This report contains records of water wells, test holes, springs, and low-flow stream discharges for the Antlers aquifer, southeastern Oklahoma. Results of analyses for common constituents, selected trace elements, and radiochemical constituents in water from selected wells are included also. (Woodard-USGS)
W79-05590

SURFACE AND GROUNDWATER STUDY OF THE WHITE RIVER, OSAWES COUNTY, NEBRASKA,
Chadron State Coll., NE.
L. Agenbroad.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 267, Price codes: A03 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska, Lincoln. Project Completion Rept. Sept. 1978, 25 p. OWRT A-060-NEB(1), 14-34-0001-8029.

Descriptors: Data collection, *Stream gaging, Groundwater, Surface water, White River, Precipitation, Network.

The objective was to survey, monitor and analyze the local hydrologic conditions of the White River watershed in Nebraska. Initial work began began in July 1972 and has continued sporadically since that date. The data collection network includes both a stream gage and well monitoring system for a 675-square mile portion of the watershed. Surface water quality data are being collected as well as precipitation data from an expanded rain gage network. Preliminary analysis of the precipitation, groundwater and surface water data has begun. Presently, 7 1/2-minute topographic maps are not available, thus a flow net analysis of the study area has not yet begun. Surface water acreage has been determined for consumptive use calculations. Preparation for nitrate and phosphate analysis has been made, and stream terrace mapping has begun.
W79-05801

WALKER BRANCH WATERSHED: SITE DESCRIPTION AND RESEARCH SCOPE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
W. F. Harris.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-770209-8, Price codes: A02 in paper copy, A01 in microfiche. Publication No 1070. (1977). 15 p, 2 fig, 32 ref. ERDA-NSF-AG-199, DEB76-00761.

Descriptors: *Watersheds(Basins), *Nutrients, *Instrumentation, *Appalachian mountain region, *Tennessee, *Biological communities, *Hydrologic budgets, Hydrology, Mountain forests, Ecosystems, Budgeting, Forest watersheds, Chemicals, Streams, Model studies.

Walker Branch Watershed is located in the Ridge and Valley section of Tennessee. The watershed (97 hectare consisting of 2 subwatersheds) is underlain by Knox Dolomite; soils formed over the dolomitic substrate are deep, well-drained Typic Paleudults. The watershed is forested. The overstory is predominantly oak-hickory, with lesser amounts of pine and mesic hardwoods. The project was initiated in 1967 with the following objectives: (1) to relate the productivity and water quality of the stream to the productivity and nutrient balance of the adjacent terrestrial ecosystem; (2) to relate the net loss of nutrient elements to the rate of nutrient cycling; (3) to define the relationship between the hydrologic cycle and nutrient flux; (4) to provide benchmark information on natural terrestrial-aquatic ecosystems for comparison with man-modified situations; and (5) to enable the measurement of environmental degradation caused by man's cultural practices. Research has been completed or is on-going in several distinct, but related, areas: ecosystem analysis of essential element dynamics, atmospheric and hydrologic input-output processes, and trace element biogeochemistry. Objectives have been approached by analysis of the role of important biological and physical processes, attempting then to relate this understanding to the observed behavior of the landscape unit. In this research, mathematical modeling was used to organize and analyze data and to formulate a direction for field research. (Adams-ISWS)
W79-05837

APPLICATION OF RIDGE REGRESSION ANALYSIS TO WATER RESOURCES STUDIES,
Agricultural Research and Education Center, Belle Glade.
S. F. Shih, and W. F. P. Shih.
Journal of Hydrology, Vol. 40, No. 1/2, p 165-174, January 1979. 2 fig, 2 tab, 16 ref.

Descriptors: *Water resources, *Florida, *Water balance, *Lakes, *Regression analysis, Rainfall, Inflow, Discharge(Water), Evaporation, Water levels, Storage, Water storage, Water supply, Analytical techniques, *Lake Okeechobee(FL), Analysis application.

Ridge regression was introduced to solve the multicollinearity in multiple regression. The water storage computation for Lake Okeechobee, Florida, was used as an example to demonstrate the techniques of applications. The performance of optimum ridge regression analysis (OPT) was compared with the ordinary least-squares method(OLS). The results of ridge regression analysis showed that the computed lake storage deviation from record was affected not only by the inflow, as inferred from the OLS method, but also by both rainfall and inflow. The mean square error of estimation obtained by the OPT method decreased about 42% from that obtained by the OLS method. (Sims-ISWS)
W79-05853

REGIONAL MEAN BOWEN RATIOS DEDUCED FROM DIURNAL CHANGES OF TEMPERATURE AND HUMIDITY,
Edinburgh Univ. (Scotland). Dept. of Meteorology.
J. C. Curran.
Journal of Hydrology, Vol. 40, No. 1/2, p 113-121, January 1979. 5 fig, 15 ref.

Descriptors: *Temperature, *Humidity, *Europe, Vertical migration, Mixing, Boundary layers, Entrainment, Profiles, Climatology, Maps, Annual, *Bowen ratio, Vertical mixing, Planetary boundary layer, Entrainment theory, Vertical profiles, Potential temperature, Climatological parameters, Annual sunshine.

The ratio of diurnal changes of temperature and humidity appeared unrelated to local Bowen ratio unless vertical mixing within the planetary boundary layer was taken into account. This was accomplished by extending entrainment theory and relating the mean annual vertical profiles of potential temperature and humidity to the climatological parameter of annual sunshine. It was then possible to calculate regional mean Bowen ratios from mean diurnal changes of temperature and humidity. As an example of the method, a map of European Bowen ratios was constructed. (Roberts-ISWS)
W79-05883

BENTHIC INVERTEBRATES IN A NORTH-FLOWING STREAM AND A SOUTH-FLOWING STREAM, BROOKS RANGE, ALASKA,
Geological Survey, Menlo Park, CA. Water Resources Div.; and Geological Survey, Menlo Park, CA. Conservation Div.
K. V. Slack, J. W. Nauman, and L. J. Tilley.
Water Resources Bulletin, Vol 15, No 1, p 108-135,

February 1979. 5 fig, 7 tab, 86 ref.

Descriptors: *Benthic fauna, *Alaska, *Natural streams, *Baseline studies, *Invertebrates, *Distribution patterns, Sampling, Diversification, Lotic environment, *Chironomidae, *Pre-trans-Alaska pipeline, Fifth-order streams, Brooks Range area.

Benthic invertebrate faunas were compared to two fifth-order streams in Alaska, the Atigun River flowing northward and the Dietrich River flowing southward. The trans-Alaska pipeline corridor traverses both drainage basins, crossing the Continental Divide at Atigun Pass. This study, which preceded pipeline and road construction, was conducted when the area was essentially free from cultural influences. The objectives were to compare species composition and diversity in arctic streams of similar size but different aspect and to examine the relationship between stream order and faunal distribution. The study was conducted during a four-day period in August 1971. Sixty-eight taxa were collected, forty-nine from each stream. Aquatic insects comprised 88% of the taxa and 97% of the individuals from the Dietrich River and 73% of the taxa and 97% of the individuals from the Atigun River. Diptera, especially Chironomidae, were most abundant. Plecoptera, Ephemeroptera, Oligochaeta, Acarina, and Collembola were significant. In both streams the headwaters were dominated by the subfamily Diamesinae which was replaced by Orthocladiinae downstream. Diversity seemed to increase with stream order. Cluster analysis showed a high degree of resemblance between the benthic faunas of the rivers. Faunal resemblance decreased with increasing distance between stations, both within and between the streams. (Woodard-USGS)
W79-05965

2B. Precipitation

ANALYSIS OF COOL SEASON LAKE-RELATED MESOSCALE PHENOMENA USING NUMERICAL VARIATIONAL ANALYSIS,
National Weather Service, Silver Spring, MD. Techniques Development Lab.
T. H. Grayson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 619, Price codes: A09 in paper copy, A01 in microfiche. Final Report, December 1976. 174 p, 63 fig, 5 tab, 61 ref, 2 append.

Descriptors: *Weather, *Arctic, *Lakes, *Great Lakes, *Model studies, *Lake Ontario, Winds, Atmospheric pressure, Temperature, Air temperature, Convection, Winter, Atmosphere, Precipitation(Atmospheric), Mathematical models, Meteorology, Mesoscale.

An analysis model, based on Sasaki's variational technique, was utilized to describe the fields of atmospheric motion, temperature, and specific humidity over Lake Ontario at 2 times during the invasion of the lake by an Arctic air mass. The 2 times chosen were: (1) when the leading edge of the cold air mass was encroaching upon the lake, and (2) 15 hours later, when the air mass completely filled the lake basin. Special surface and upper-air data collected in conjunction with the International Field Year for the Great Lakes were interpolated to 11 sigma surfaces extending from the earth's surface to 500 mb. The weak constraint variational formulation was used with variable weights assigned to the interpolated data. The analyses showed that the cold surge was accompanied by 3 lines of organized convective activity over the lake. Surface convergences of greater than 0.0004/s were associated with the lead squall line, while convergences of 0.0002/s were associated with the other areas of convective activity. (Sims-ISWS)
W79-05523

CLIMATIC ROLES OF ICE: A CONTRIBUTION TO THE INTERNATIONAL HYDROLOGICAL PROGRAMME (IHP),
Colorado Univ., Boulder.
For primary bibliographic entry see Field 2C.
W79-05527

EFFECT OF CLIMATIC WARMING ON THE WEST ANTARCTIC ICE SHEET,
Maine Univ. at Orono. Inst. for Quaternary Studies.
For primary bibliographic entry see Field 2C.
W79-05528

DRY CLIMATES--PAST AND PRESENT,
For primary bibliographic entry see Field 2A.
W79-05570

MAXIMUM RAINFALL INTENSITY IN DIFFERENT PERIOD INTERVALS IN IRAQ,
Institute for Applied Research on National Resources, Baghdad (Iraq).
M. Gangopadhyaya, and G. F. Kaka.
Journal of the Geological Society of Iraq, Vol. 8, p 48-56, 1975. 2 tab, 4 fig, 3 ref.

Descriptors: *Rainfall intensity, *Probable maximum precipitation, *Weather patterns, *Iraq, *Weather data, *Depth-area-duration analysis, *Project planning, Design flood, Rainfall disposition, Run-off forecasting, Distribution patterns, Analytical techniques, Frequency, Industrial growth, Planning, Data collections, Climatic data.

Iraq's national development plan, putting emphasis upon industrial growth, will require special climatological data to adequately design drainage networks and choose suitable locations in the event of temporary flooding. Primary to this endeavor is the determination of maximum possible rainfall intensities for short intervals. Unfortunately the country has an insufficiently long series of data and too few recording stations upon which to derive these estimations. In order to overcome this difficulty all of the available data from all of the stations in Iraq was pooled and it was assumed that the whole country is meteorologically homogeneous. This assumption was justified on the consideration that the situations which produce high intensity rainfall (depressions, instability phenomenon, etc.) occur with the same degree of efficiency in all parts of Iraq. On this basis, a formula where rainfall intensity measured in millimeters per hour and time in hours during which the intensity is measured provides a fair estimate of the maximum rainfall intensity during various intervals. (Tickes-Arizona)
W79-05571

REVIEW REPORT ON UMPQUA RIVER AND TRIBUTARIES, OREGON, INTERIM REPORT, SOUTH UMPQUA RIVER, VOLUME III; (APPENDIX B--HYDROLOGY, METEOROLOGY, AND RESERVOIR REGULATION; APPENDIX C--FOUNDATION AND MATERIALS DATA; APPENDIX D--RECREATION, PUBLIC USE, AND ENVIRONMENT),
Army Engineers District, Portland, OR.
For primary bibliographic entry see Field 8A.
W79-05616

COMPUTATION OF THE AVERAGE PRECIPITATION OVER THE WESTERN PART OF PENINSULAR INDIA DURING THE SUMMER MONSOON FROM THE CONTINUITY EQUATION FOR ATMOSPHERIC WATER VAPOUR,
Institute of Tropical Meteorology, Poona (India).
S. N. Bavadekar, and D. A. Mooley.
Tellus, Vol. 30, No. 6, p 537-541, December 1978. 1 fig, 4 tab, 3 ref.

Descriptors: *Monsoons, *Precipitation(Atmospheric), *Water vapor, *Model studies, Mathematical models, Equations, Evapotranspiration, Winds, Humidity, Moisture content, Rainfall, Weather, Meteorology, *India, Convergence, Water vapor flux.

Water vapor fluxes computed across different walls of the triangular volume of peninsular India, bounded by Trivandrum, Bombay, and Nagpur, were used to compute the net flux convergence on a monthly mean basis for the months June through September for the years 1967-72. The precipitation rates over the region were computed by using the flux convergence values and the equation of continuity for water vapor and were compared with the actual rainfall. The agreement between the computed precipitation and actual rainfall was found to be fairly close. (Sims-ISWS)
W79-05619

ACID PRECIPITATION IN THE NEW YORK METROPOLITAN AREA: ITS RELATIONSHIP TO METEOROLOGICAL FACTORS,
Interstate Sanitation Commission, New York.
For primary bibliographic entry see Field 2K.
W79-05626

A STATISTICAL STUDY OF THE ANNUAL RAINFALL IN THE SUTLEJ CATCHMENT AND ANNUAL RUN-OFF AT BHAKRA DAM SITE,
Meteorological Office, New Delhi (India).
R. S. Pareek, S. K. Dube, and S. D. S. Abbi.
Indian Journal of Meteorology, Hydrology, and Geophysics, Vol. 27, No. 3, p 309-315, July 1976. 4 fig, 4 tab, 10 ref.

Descriptors: *Rainfall, *Runoff, *Statistics, Annual, Data processing, Weather data, Precipitation(Atmospheric), Analytical techniques, Statistical methods, Average runoff, Variability, Time series analysis, Mathematics, Weather, Meteorology, *India.

An analysis of the annual rainfall of three selected stations with long term data in Sutlej catchment and the annual runoff at Bhakra dam site was made for their averages and standard deviations. Each series was examined for general trend by (1) the low pass filter, (2) Mann-Kendall test and (3) comparison of short period averages with long period average. Further, the periodicities in the data series were examined by power spectral analysis. (Sims-ISWS)
W79-05628

A STUDY OF LARGE FLOODS IN THE THAMBRAPARANI RIVER IN TAMIL NADU,
Observatory, New Delhi (India).
For primary bibliographic entry see Field 2E.
W79-05629

ASSESSMENT OF WEATHER MODIFICATION IN ALLEVIATING AGRICULTURAL WATER SHORTAGES DURING DROUGHTS,
Illinois State Water Survey, Urbana.
F. A. Huff, and J. L. Vogel.
Final Report, December 1977. 142 p, 34 fig, 44 tab, 39 ref, 2 append. NSF ENV74-24367.

Descriptors: *Weather modification, *Cloud seeding, *Droughts, *Agriculture, *Illinois, Rainfall, Precipitation(Atmospheric), Clouds, Statistics, Depth-area curves, Spatial distribution, Temporal distribution, Distribution patterns, Cloud physics, Climatology, Meteorology.

The major objective was to assess the potential utility of weather modification in stimulating crop production during droughts of various severity in the Midwest. A secondary objective was to develop techniques for applying precipitation climatology in assessing the feasibility and potential benefits of cloud seeding during growing season droughts. This research was limited to Illinois which is typical of much of the Midwest in climate, soils, and crop production. Analytical results were presented which describe the natural rainfall distribution in droughts of various severity in Illinois. Relationships were provided among storm mean rainfall, areal extent of storm rainfall, rainfall intensity, and drought size (severity) on the basis of frequency of occurrence. Synoptic weather conditions under which drought rainfall occurs most frequently, its diurnal distribution, and other factors pertinent to planned weather modification were discussed. This information can be used to evaluate weather modi-

fication potential and to plan cloud seeding operations, provided that the weather modifier can specify enhancement capabilities under various combinations of natural weather conditions, and that the agriculturist can define the economic benefits that would be derived from the specified enhancement. (Sims-ISWS)
W79-05836

MONITORING AREAWIDE RURAL WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W79-05842

AN AUTOMATIC SEQUENTIAL RAIN SAMPLER,
Laboratoire de Chimie Inorganique et Nucleaire, Chemin du Cyclotron, Louvain (Belgium).
For primary bibliographic entry see Field 7B.
W79-05847

THE OCCURRENCE OF ORGANOCHLORINE RESIDUES IN RAINWATER,
Freshwater Fisheries Lab., Pitlochry (Scotland).
For primary bibliographic entry see Field 5A.
W79-05848

WET AND DRY DEPOSITION OF NUTRIENTS IN CENTRAL ALBERTA,
Alberta Univ., Edmonton.
For primary bibliographic entry see Field 5B.
W79-05849

AN ANALYTICAL MODEL OF RAINFALL INTERCEPTION BY FORESTS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2D.
W79-05854

PERSISTENCE AND OROGRAPHIC MODULATION OF MESOSCALE PRECIPITATION AREAS IN A POTENTIALLY UNSTABLE WARM SECTOR,
Royal Signals and Radar Establishment, Malvern (England). Radar Research Lab.
F. F. Hill, and K. A. Browning.
Quarterly Journal of the Royal Meteorological Society, Vol. 105, No. 443, p 57-70, January 1979. 10 fig, 17 ref.

Descriptors: *Precipitation(Atmospheric), *Rainfall, *Orography, *Persistence, Weather, Distribution patterns, Rain gages, Radar, Remote sensing, Movement, Data processing, Analytical techniques, Meteorology, *England.

Data from radars and raingages in England, Wales, and southern Ireland were used to study the motion and changes in intensity of mesoscale precipitation areas (MPAs) some tens of kilometres across as they traversed two regions of high land and an intervening stretch of sea. The MPAs studied were associated with an area of middle-level potential instability within a windy and moist wintertime warm sector, a situation known to produce major orographic effects. Despite the very large modulation of the rainfall intensity by orography, it was found that most of the MPAs could be tracked for 6 h over a distance of 600 km, all the way from the west coast of Ireland to southern England. The implications of this were discussed with regard to the use of radar and satellite data in short-period forecasting. (Sims-ISWS)
W79-05855

DEW AND THERMAL LAG: A MODEL FOR COCOA PODS,
Nottingham Univ. (England). School of Agriculture.
J. L. Monteith, and D. R. Butler.
Quarterly Journal of the Royal Meteorological Society, Vol. 105, No. 443, p 207-215, January 1979. 7 fig, 10 ref.

Descriptors: *Dew, *Dew point, *Condensation, *Model studies, Mathematical models, Humidity, Temperature, Air temperature, Heat balance, Heat transfer, Thermal capacity, Wetting, Winds, Meteorology, *Cocoa pods, Black Pod disease.

Dew forms on cocoa pods after sunrise when the dew-point temperature of air in the canopy rises faster than the surface temperature of the pods. Exchanges of heat and water vapor were estimated by treating a pod as an isothermal body with homogeneous thermal properties. Two treatments of this simple model were discussed. First, the heat balance equation was simplified to a form which allowed the environmental limits for condensation to be derived explicitly. Second, the equation was solved numerically to find the duration and mean depth of wetness as a function of environmental variables. Consistent with observation, the thermal lag of the pod was about 1 to 3K; condensation to a depth of 10 to 20 micrometers occurs when air at sunrise is almost saturated and windspeed is light. Condensation on cocoa pods is likely to be significant in the spread of Black Pod, a serious fungal disease. (Sims-ISWS)
W79-05856

PROBABLE MAXIMUM PRECIPITATION ESTIMATES, UNITED STATES EAST OF THE 105TH MERIDIAN,
National Weather Service, Silver Spring, MD. Office of Hydrology.
L. C. Schreiner, and J. T. Riedel.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50 Hydrometeorological Report No. 51, Washington, D.C., June 1978. 93 p, 47 fig, 5 tab, 38 ref, 1 append.

Descriptors: *Probable maximum precipitation, *Precipitation(Atmospheric), *Probability, *United States, Maps, Estimating, Storms, Rainfall intensity, Drainage area, Duration curves, Time, Meteorology, Data collection, *Generalized estimates, *Rainfall rates, All-season estimates, Individual drainage estimates, Hypothetical areal rainfall.

Generalized estimates of probable maximum precipitation, the greatest rainfall rates for specified durations theoretically possible, were presented for the United States east of the 105th meridian. They were all-season estimates, the greatest for any time of the year, for drainages from 10 to 20,000 square miles and for durations of 6 to 72 hours. Details of the procedures and methods used for developing the estimates were described. Critical spring soil conditions with snow on the ground, in combination with spring season probable maximum precipitation values, could yield greater flood peaks. The probable maximum precipitation values of this study were termed generalized estimates, which means that isolines of probable maximum precipitation were given on a map, allowing determination of average probable maximum precipitation for any drainage. (Roberts-ISWS)
W79-05863

2C. Snow, Ice, and Frost

ESTIMATION OF SNOW TEMPERATURE AND MEAN CRYSTAL RADIUS FROM REMOTE MULTISPECTRAL PASSIVE MICROWAVE MEASUREMENTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
A. T. C. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-26677, Price codes: A02 in paper copy, A01 in microfiche. NASA Technical Paper 1251, June 1978. 14 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Remote sensing, *Snow cover, *Microwaves, *Model studies, Mathematical models, Snow, Measurement, Satellites(Artificial), Temperature, Melting, Snowmelt, Meltwater, Ice, Water resources, Equations, Data processing, Statistical methods, Analytical techniques, Microwave emission, Radiometry, Rayleigh scattering.

Recent work by A.T.C. Chang, et al, has demonstrated that variation in crystal size and physical temperature of snowfield observations from space give large variations in the microwave brightness temperature. Since the brightness temperature is a function of wavelength, the microwave brightness temperature can be used to extract the snow temperature and mean crystal radius profiles. The Scanning Multichannel Microwave Radiometer (SMMR), to be launched on board the Nimbus-G and Seasat-A spacecraft, will make observations in wavelengths of 0.8, 1.4, 1.7, 2.8, and 4.6 cm. A statistical retrieval method was developed in this paper to determine the snowfield temperature profile and mean crystal size by using the scanning multifrequency microwave radiometer on board a spacecraft. The estimated errors for retrieval are approximately 1.5 K for temperature and 0.001 cm for crystal radius in the presence of 1 K rms noise for each SMMR channel. The computational method presented may also provide a basis for utilizing SMMR data to further develop a new retrieval technique for eventual incorporation into satellite weather and climate data collecting systems. (See also W77-10687) (Froehlich-ISWS)
W79-05518

CLIMATIC ROLES OF ICE: A CONTRIBUTION TO THE INTERNATIONAL HYDROLOGICAL PROGRAMME (IHP),
Colorado Univ., Boulder.
U. Radok.
Hydrological Sciences Bulletin, Vol. 23, No. 3, p 333-354, September 1978. 7 fig, 1 tab, 89 ref.

Descriptors: *Ice, *Climatology, *Glaciology, *Model studies, *Antarctic, Mathematical models, Glaciers, Sea ice, Snow, Snow cover, Mountains, Polar regions, Climates, Weather, Temperature, Meteorology, Reviews, Ice sheets, Ice sheet dynamics, Mountain glaciers.

Terrestrial ice is featuring prominently in current speculations about consequences and causes of marked climatic anomalies. This review was an attempt to provide the climate debate with a cryospheric sense of proportion matching present glaciological knowledge and understanding. Short climatic fluctuations on the time scale of months to decades involve primarily the seasonal and more 'volatile' ice forms, snow and sea ice. Focused process experiments and effective monitoring techniques for the extents and characteristics of climate fluctuations, both in regional detail and in global completeness, are laying a firm basis for incorporating these cryospheric features into climate models and for testing model results against current reality. It was concluded that snow and sea ice have now emerged from their basic problematics, covered by a few references to the published literature. The more traditional cryospheric emphasis in climatology has been on the behavior of glaciers and ice sheets. Progress towards computer modelling of glaciers was appraised. Although at the opposite end of the time scales of climate, polar ice sheets are as important for understanding climate as are snow and sea ice. Cores from these ice sheets provide records of their history which has created their temperature and their distribution of stable and radioactive isotopes, trace chemicals, and dust. But the dynamics of these ice masses is also involved and must be modelled for an unambiguous interpretation of the core records in terms of past climate. (Sims-ISWS)
W79-05527

EFFECT OF CLIMATIC WARMING ON THE WEST ANTARCTIC ICE SHEET,
Maine Univ. at Orono. Inst. for Quaternary Studies.
R. H. Thomas, T. J. O. Sanderson, and K. E. Rose.
Nature, Vol. 277, No. 5695, p 355-358, February 1, 1979. 3 fig, 18 ref.

Descriptors: *Glaciers, *Antarctic, *Climatology, Melting, Warming, Climates, Ice, Cold regions,

Sea level, Temperature, Air temperature, Water temperature, Meteorology, Ice sheets, Ice shelves.

Climatic warming could cause increased melting from Antarctic ice shelves. Continued weakening of the ice shelves in this way would result in the ultimate collapse of most of the West Antarctic ice sheet. For complete removal of the ice shelves, collapse of the ice sheet and a 5 m rise in world sea level could occur in less than 100 yr. More realistically, ice-shelf deterioration is likely to be a rather slow process. Even for a major and sustained warming trend, ice-sheet collapse would take several hundred years, with most of the associated rise in sea level occurring during the final century. However, little is known about the glaciers that drain the northern part of the ice sheet. These glaciers have little or no protective fringe of ice shelf and, unless they flow over sufficiently high bedrock sills, they may show a more rapid response to increased temperatures. (Sims-ISWS)
W79-05528

PROBLEMS OF THE PERIGLACIAL ZONE (ZAGADNIENIA STREFY PERYGLACJALNEJ),
A. Jahn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-248 901, Price codes: A13 in paper copy, A01 in microfiche. TT 72-54011, U.S. Department of Commerce, National Technical Information Service, Springfield, Virginia, 1975. 134 p, 129 fig, 116 photo, 583 ref.

Descriptors: *Geologic history, *Glaciation, *Europe, Climates, Underground, Valleys, Foreign countries, Foreign research, Pleistocene epoch, Geology, Permafrost, Glaciology, Ice, Karst, Frost, Lakes, Thawing, Erosion, Slopes, Loess, Oscillation, Cold regions, *Periglacial zone, Ice wedges.

Sixty years have passed since a new field of study concerned with the geographic periglacial zone was inaugurated. After the last war, as more and more factual material has been collected, interest in this field of study has grown. Periglacial research centers have been established in various countries, including Poland, the Soviet Union, France, Federal Republic of Germany, and the United States. What is behind this world-wide appreciation of periglacial problems. The answer seems to be that these problems run over a broad front and across the boundaries of three sciences, geology, geography, and pedology. In this setting they open great opportunities for researchers in various fields of study. They relate to contemporary phenomena and to facts dating to recent geological past of the earth, and consequently the comparative method, so favored in natural sciences, can be applied here most successfully. This book gives the reader a survey of periglacial problems, which were considered, in every instance, in the comparative aspect: contemporary-Pleistocene periglacial zone. (Froehlich-ISWS)
W79-05545

THE USE OF SNOWCOVERED AREA IN RUNOFF FORECASTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
A. Rango, J. F. Hannaford, R. L. Hall, M. Rosenzweig, and A. J. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-16410, Price codes: A03 in paper copy, A01 in microfiche. NASA Technical Memorandum 78083, March 1977. 29 p, 5 fig, 4 tab, 4 ref. NAS5-22957.

Descriptors: *Remote sensing, *Snowmelt, *Runoff forecasting, *Water supply, Data collections, Snowpacks, Orography, Methodology, Statistical analysis, Investigations, *Snowcovered areas, *Sierra Nevada Mountains, Snowpack index, Precipitation index.

Long-term, snowcovered area data from aircraft and satellite observations were investigated for application to water supply forecasting in California's southern Sierra Nevada Mountains. These observations have proven useful in reducing seasonal runoff forecast error on the Kern River watershed when incorporated into procedures to update water supply forecasts as the melt season progresses. Similar use of snowcovered area on the Kings River watershed produced results that were about equivalent to methods based solely on conventional data. Snowcovered area will be most effective in reducing forecast procedural error on watersheds with: (1) a substantial amount of area within a limited elevation range; (2) an erratic precipitation and/or snowpack accumulation pattern not strongly related to elevation; and (3) poor coverage by precipitation stations or snow courses restricting adequate indexing of water supply conditions. When satellite data acquisition and delivery problems are resolved, the derived snowcover information should provide a means for enhancing operational streamflow forecasts for areas that depend primarily on snowmelt for their water supply. (Singh-ISWS)
W79-05611

EASTERN-WESTERN ARCTIC SEA ICE ANALYSES,
Fleet Weather Facility, Suitland, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 353, Price codes: A10 in paper copy, A01 in microfiche. Report, 1976. 210 p, 104 fig.

Descriptors: *Sea ice, *Remote sensing, *Mapping, *Arctic, Satellites(Artificial), Ice cover, Ice, Temperature, Data collections, Data processing, Maps, Climatology, *Northern hemisphere.

The Navy has a long and colorful history of polar exploration and currently is an active participant in the growing national activity in the Arctic and Antarctic. The strategic importance and increased demand for the natural resources of these areas have resulted in a greater requirement for environmental information. The principal aim of this publication was to provide operators and researchers with historical weekly hemispheric analyses of sea ice conditions derived principally from satellite imagery supplemented by conventional observations for 1976. The charts were constructed by Navy ice analysts under operational time constraints from satellite imagery and conventional data. Reanalysis with late data was not normally attempted, but rather, the current analysis was prepared incorporating the late data to the extent possible. The analysis was compared with available climatology in an attempt to eliminate gross errors. Scanning radiometer imagery, visual and infrared, from the National Oceanic and Atmospheric Administration satellites and microwave radiometer data from the NIMBUS V research satellite were the primary data sources. (Sims-ISWS)
W79-05613

LAKE ERIE ICE: WINTER 1975-76,
National Oceanic and Atmospheric Administration, Rockville, MD. Environmental Science Information Center.
J. H. Wartha.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 386, Price codes: A05 in paper copy, A01 in microfiche. NOAA Technical Memorandum NESS 90, August 1977. 68 p, 39 fig, 3 ref, 1 append.

Descriptors: *Lake Erie, *Ice, *Data collections, *Remote sensing, Lakes, Ice cover, Movement, Satellites(Artificial), Climatic data, Meteorological data, Iced lakes, Surface waters, Spatial distribution.

This report included satellite data from the NOAA-4 VHRR, National Oceanic and Atmospheric Administration's Geostationary Operational Environmental Satellite, and the National Aeronautics and Space Administration's Landsat, Canadian aerial ice reconnaissance, and aircraft Side Looking Airborne Radar systems. These data were used to trace the development, movement, and dissipation of lake ice from December 28, 1975 to April 19, 1976 at intervals of about 3 days. Wind speeds and directions were correlated with ice movement, and air temperatures were related to ice formation and dissipation. Ice conditions were generally normal; however, ice persisted in the eastern end of the lake until mid-April. This unusually late date for clearing was caused more by winds concentrating the ice than by very cold weather. (Humphreys-ISWS)
W79-05615

APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY,
Norges Vassdrags- og Elektrisitetsvensen, Oslo.
For primary bibliographic entry see Field 7B.
W79-05617

SNOW AND ICE IN THE PHOSPHORUS BUDGET OF A LAKE IN SOUTH CENTRAL ONTARIO,
Trent Univ., Peterborough (Ontario).
W. P. Adams, M. C. English, and D. C. Lasenby.
Water Research, Vol. 13, No. 2, p 213-215, 1979. 1 fig, 2 tab, 9 ref.

Descriptors: *Phosphorus, *Canada, *Lakes, *Ice, *Snow, Nutrients, Precipitation(Atmospheric), Snowfall, Lake ice, Iced lakes, On-site investigations, Chemicals, Chemical analysis, Chemistry, Limnology, *Coon Lake(Ontario), *Ontario.

Roles of snow and various forms of ice in the phosphorus cycle of a lake were discussed. It was pointed out that precipitation falling directly onto a lake ice sheet during the winter has a disproportionately large impact on the lake system in the spring. Phosphorus derived from snow incorporated into the ice sheet must be included if accurate estimates of spring phosphorus loading are to be made. Data from Coon lake, Ontario, were used to illustrate points made. (Sims-ISWS)
W79-05620

A LARGE-SCALE NUMERICAL MODEL OF SEA ICE,
National Center for Atmospheric Research, Boulder, CO.
C. L. Parkinson, and W. M. Washington.
Journal of Geophysical Research, Vol. 84, No. C1, p 311-337, January 20, 1979. 28 fig, 3 tab, 86 ref. NSF ATM76-08492.

Descriptors: *Sea ice, *Arctic, *Arctic Ocean, *Antarctic, *Antarctic Ocean, *Model studies, Mathematical models, Ice, Cold regions, Winds, Temperature, Air temperature, Water temperature, Humidity, Heat flow, Heat transfer, Freezing, Melting, Clouds, Atmosphere, Oceans, Simulation analysis.

Work at the National Center for Atmospheric Research has resulted in the construction of a large-scale, sea-ice model capable of coupling with atmospheric and oceanic models of comparable resolution. The sea-ice model itself simulated the yearly cycle of ice in both the northern and the southern hemispheres. Horizontally, the resolution was approximately 200 km, while vertically the model included 4 layers: ice, snow, ocean, and atmosphere. Both thermodynamic and dynamic processes were incorporated, the thermodynamics being based on energy balances at the various interfaces and the dynamics being based on the following 5 stresses: wind stress, water stress, Coriolis force, internal ice resistance, and the stress from the tilt of the sea surface. Although the ice within a given grid square was of uniform thickness, each square also had a variable percentage of its area assumed ice free. The model results produced a reasonable yearly cycle of sea-ice thickness and extent in both the Arctic and the Antarctic. The arctic ice grows from a minimum in September, when the edge has retreated from most coastlines, to a maximum in March, when the ice has reached well into the Bering Sea, has blocked the north coast of Iceland, and has moved southward of the southernmost tip of Greenland. Maximum arctic thicknesses are close to 4 m. In the Antarctic, the ice expands from a minimum in March to a maximum in late August, remaining close to the continent in the former month and

extending northward of 60 deg S in the latter month. Maximum thicknesses are about 1.4 m. The distribution of modeled ice concentrations correctly revealed a more compact ice cover in the northern hemisphere than in the southern hemisphere. (Sims-ISWS).
W79-05632

PHYSICAL MEASUREMENT OF ICE JAMS, 1976-77 FIELD SEASON,
Army Terrestrial Sciences Center, Hanover, NH. Applied Research Branch.
J. L. Wuebben, and D. M. Stewart.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-053 260, Price codes: A03 in paper copy, A01 in microfiche. Special Report 78-3, March 1978. 21 p, 21 fig, 2 tab, 2 ref, 2 append.

Descriptors: *Ice jams, *Rivers, *Measurement, *Vermont, Ice, Streamflow, Runoff, Storms, Water levels, Profiles, Hydrographs, On-site investigations, On-site data collections, Ice cover, Winter, *Ottauquechee River(VT).

Three shallow stream ice jams which occurred on the Ottauquechee River in Vermont during the 1976-77 winter season were documented. Measurements of the variation in jam thickness along the longitudinal profile of the jams were given along with the variation in surface ice floe sizes. These measurements were compared with those of previous work. All jams were caused, to some extent, by backwater conditions in the river. The effects of an ice cover and the ice jams on the longitudinal water surface profiles were examined and compared with open water conditions. (Sims-ISWS)
W79-05833

MELTING OF ICE IN SEA WATER: A PRIMITIVE MODEL WITH APPLICATION TO THE ANTARCTIC ICE SHELF AND ICEBERGS,
Bergen Univ. (Norway). Geophysical Inst.
H. G. Gade.
Journal of Physical Oceanography, Vol. 9, No. 1, p 189-198, January 1979. 6 fig, 17 ref, 1 append.

Descriptors: *Ice, *Sea water, *Melting, *Model studies, Mathematical models, Temperature, Water temperature, Salinity, Oceans, Icebergs, Melt water, Mixing, Heat transfer, Oceanography.

Steady-state conditions are assumed to exist everywhere in the case of melting of the underside of an infinite slab of ice floating in seawater. Basic transfer equations for heat and salt were established, and solutions were derived for the interior corresponding to given far field values of the temperature and salinity of the water. The solutions were discussed in the T-S diagram where the behavior is particularly simple. Determining parameters are the characteristic velocities k sub s/d and K sub s/h, where k sub s and K sub s are the molecular and turbulent diffusivities, respectively, of salt, and d and h are the thicknesses of the corresponding laminar and turbulent layers. Also, the nonmelting/nonfreezing case was discussed, and the determining parameter was established. Application of the theory to the Ross Ice Shelf (Little America V) gave acceptable results, with d = 0.002 m and K sub s = 0.002 - 0.003 sq m/s. Analysis of the static stability of the meltwater mixtures revealed that with ambient temperatures approaching 17C, the stratification becomes unstable. Icebergs brought to tropical waters will cause meltwater mixtures to intrude at subsurface levels. Finally, convection obtained in laboratory experiments with melting ice in seawater was reported to be in concordance with the theoretically derived stability criterion. (Sims-ISWS)
W79-05857

RIVER ICE,
Army Terrestrial Sciences Center, Hanover, NH. Snow and Ice Branch.
G. D. Ashton.
American Scientist, Vol. 67, No. 1, p 38-45, January-February 1979. 9 fig, 21 ref.

Descriptors: *Ice, *Rivers, *Ice cover, *Ice jams, Frazil ice, Freezing, Heat balance, Icewater interfaces, Analytical techniques, Heated water, Ripple marks, Melting, Ice formation, Ice thickening, Ice ripples.

The presence of ice on rivers changes the behavior of rivers, interferes with their use, and causes severe economic disruption. River ice may be characterized as a series of quasi-steady states that exist between short periods of intense change. These short periods, while most significant in establishing the next steady state, are also the most difficult to observe, predict, and understand. This paper discussed frazil ice formation, thickening of ice cover, ice ripples and rotting of ice cover, ice jams, and effects of thermal effluents. Many subtopics were not touched upon in this brief overview, including ice-retention structures, forces due to ice action, winter navigation in ice-covered rivers, and mechanical properties of ice. The Cold Regions Research and Engineering Laboratory has just completed construction of a major facility for the study of many of the subjects discussed. Recently, the development of a pulsed-radar system has provided a means to measure ice thicknesses remotely without recourse to physical penetration and measurement, and it will allow acquisition of the all-important field data necessary to verify laboratory and analytical findings. (Humphreys-ISWS)
W79-05860

2D. Evaporation and Transpiration

EQUILIBRIUM AND ACTUAL EVAPOTRANSPIRATION FROM A VERY DRY VEGETATED SURFACE,
British Columbia Ministry of the Environment, Kamloops.
R. J. Williams, K. Broersma, and A. L. van Ryswyk.
Journal of Applied Meteorology, Vol. 17, No. 12, p 1827-1832, December 1978. 3 fig, 1 tab, 17 ref.

Descriptors: *Equilibrium, *Evapotranspiration, *Vegetation, *Canada, Energy budget, Grasses, Measurement, Range grasses, Climatic data, Latent heat, Soil moisture, Model studies, *Vegetated surface, *Actual evapotranspiration, *British Columbia, *Kamloops(British Columbia), Equilibrium evapotranspiration, Equilibrium model.

Energy balance measurements of evapotranspiration from very dry, seeded, rangeland grass near Kamloops, British Columbia, were compared with daily equilibrium evapotranspiration estimates. The equilibrium model was found to overestimate evapotranspiration from all sites at rates much less than potential. The data indicated by extrapolation that the accepted proportionality factor alpha value of 1.26, as reported by Priestly and Taylor, is confirmed at the lower limit of potential evapotranspiration. An attempt to select values of the proportionality factor alpha to the first power, for nonpotential conditions, as a function of surface soil moisture proved to be inadequate. An attempt to establish a relationship between alpha to the first power and soil moisture in the entire root zone was also unsuccessful. (Roberts-ISWS)
W79-05529

COMPARISON OF EVAPOTRANSPIRATION RATES IN THE PLATTE RIVER IN NEBRASKA: 1938 VS 1978,
Kearney State Coll., NE.
H. G. Nagel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 265, Price codes: A03 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska, Lincoln Project Completion Report, February 1979. 36 p, 12 fig, 5 tab. OWRT A-059-NEB(1). 14-34-0001-8029.

Descriptors: *Evapotranspiration, *Platte River, Evaporation, Riparian vegetation, Forests.

A computational model was developed to estimate evapotranspiration (ET) in the Platte River ecosystem of Central Nebraska. Data used in the model were mostly derived from the literature, although leaf temperature data were collected to estimate species transpiration coefficients. Preliminary estimates for ET are 35.5 inches/year during the April to October growing season. Riparian forest accounted for 30% of the total ET, followed in order of importance by open water evaporation, forested islands, herbaceous riparian transpiration, sandbar evaporation and then herbaceous island vegetation, which accounted for only 10% of the total ET. The Platte River has changed markedly during the last 40 years, with reduced flows and narrowed channel width. Much riparian forest has grown up in that time, and vegetated islands occupy a greater percentage of the remaining channel than previously. A comparison of ET rates between the 1930's and 1970's was attempted, using the computational model developed. Total ET rates in the 1930's were about the same as today (37/3 inches/year), but proportion by habitat differed greatly, with open water evaporation probably accounting for about half the total ET then.
W79-05798

AN ANALYTICAL MODEL OF RAINFALL INTERCEPTION BY FORESTS,
Institute of Hydrology, Wallingford (England).
J. H. C. Gash.
Quarterly Journal of the Royal Meteorological Society, Vol. 105, No. 443, p 43-55, January 1979. 3 fig, 1 tab, 22 ref.

Descriptors: *Rainfall, *Interception, *Forests, *Evaporation, *Model studies, Deciduous forests, Hardwood, Precipitation(Atmospheric), Mathematical models, Regression analysis, Equations, Trees, Canopy, Wetting, On-site investigations, *Thetford Forest(East Anglia), *Great Britain.

The description of the evaporation of rainfall intercepted by forests in terms of a regression of evaporation loss on incident rainfall was discussed, and some of the assumptions implicit in that method were re-examined. The 2 major factors which control the evaporation of intercepted rainfall were identified: (1) the amount of time that the canopy spends saturated during rainfall and the evaporation rate applicable under these conditions; and (2) the canopy saturation capacity and the number of times this store is emptied by drying out after the cessation of rainfall. A model was constructed which is conceptually similar to the Rutter model, but which replaces that model's numerical approach with an analysis by storm events. The evaporation from a saturated canopy during rainfall was estimated from the Penman-Monteith equation; the following were added as separate terms: evaporation after rain has ceased, the effect of small storms insufficient to saturate the canopy, wetting-up the canopy, and evaporation from the trunks. The model was tested against data from Thetford Forest in East Anglia, with satisfactory agreement between observation and estimation. It was suggested that the model may be capable of making useful estimates of the evaporation of intercepted rainfall solely from rainfall measurements. (Sims-ISWS)
W79-05854

2E. Streamflow and Runoff

SUPERCRITICAL FLOW IN BENDS OF TRAPEZOIDAL SECTION,
Missouri Univ., Columbia, Dept. of Civil Engineering.
C. W. Lenau.
Journal of Engineering Mechanics Division, American Society of Civil Engineers, Proceedings Paper 14369, Vol. 105, No. EM1, p 43-54, February 1979. 4 fig, 10 ref, 2 append.

Descriptors: *Open channel flow, *Steady flow, *Supercritical flow, Elevation, Hydraulics, Flow, Equations, Cross-sections, Channels, Peak discharge, Mathematical studies, Hydraulic bends, Inviscid flow, Trapezoidal channels.

Steady supercritical flow in circular bends of trapezoidal cross section was analyzed for the case in which the radius of curvature of the center line is much larger than the undisturbed depth of flow h sub o. Supercritical flow in bends of trapezoidal cross section was analyzed for the case relative curvature less than 1 and Froude number greater than 2. It was found that an almost periodic pattern of crests exists along the outside edge. This pattern is exactly matched in magnitude and position by a pattern of depressions along the inside edge. The crests along the outside edge rise from near the undisturbed flow elevation to a maximum value and back down again. (Lee-ISWS)
W79-05531

SIMPLIFIED MUSKINGUM ROUTING EQUATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, Technical Note, p 85-91, January 1979. 2 fig, 1 tab, 10 ref, 2 append.

Descriptors: *Flood routing, *Flood waves, *Mathematical models, Routing, Analytical techniques, Model studies, Channels, Rivers, Equations, Discharge(Water), Flood flow, Hydrograph analysis.

The Muskingum method and its variations are well established in the flood routing literature. Traditionally, its parameters K and X have been determined by calibration using measured inflow and outflow hydrographs. An improved version is due to Cunge, who showed that parameters K and X could be related to the physical problem, thus eliminating the need for trial and error calibration while at the same time enhancing the predictive capabilities of the method. With the aid of Cunge's findings, the calculations can proceed either in a lumped parameter mode, or in a variable parameter mode. The lumped parameter mode has simplicity as its major advantage, although this is achieved at the cost of a certain loss in detail. A simplified Muskingum routing equation was developed. The method is based on the specification of the space and time intervals Delta(x) and Delta(t) such that X = O and K = Delta(t). In this case, the routing equation reduces to the computation of a simple average. Testing of the method showed that reasonably accurate results can be obtained with a minimum of computational effort. (See also W70-04590) (Humphreys-ISWS)
W79-05536

FLOW PROFILES IN TRAPEZOIDAL CHANNELS BY POCKET CALCULATORS,
Public Power Corp., Athens(Greece). Computing Center.
For primary bibliographic entry see Field 8B.
W79-05538

SUBSIDENCE OF PEAK FLOW IN CHANNELS WITH STORAGE AREAS,
National Taiwan Univ., Taipei. Dept. of Civil Engineering.
C-L. Yen.
Journal of Hydraulic Research, Vol. 16, No. 4, p 309-326, 1978. 11 fig, 3 tab, 7 ref.

Descriptors: *Channel flow, *Peak discharge, *Subsidence, *Model studies, Mathematical models, Simulation analysis, Numerical analysis, Flow, Storage, Floods, Flood plains, Vegetation effects, Hydrographs, Discharge(Water), Streamflow, Hydraulics, Subsidence functions, Storage areas.

Subsidence of peak flow in channels with storage areas having no significant longitudinal flow was investigated. Numerical simulation of unsteady flow was used for various sizes of storage area and flow conditions. Based on the results of numerical simulation, a subsidence function was defined and expressed as an exponential function of a parameter combining relative size of storage area, peak inflow, and other flow and channel factors. The coefficients in the subsidence function also were evaluated from the results of numerical simulation. Testing of the subsidence function with one set of field data yielded reasonably good results. However, further testing with more field data was recommended. (Sims-ISWS)
W79-05541

RIVER RUNOFF REGULATION AND WATER-MANAGEMENT CALCULATIONS, (METODIKA REGULIROVANIYA STOKA I VODOKHOZYAISTVENNYKH RASCHETOV),
For primary bibliographic entry see Field 4A.
W79-05544

GEOHYDROLOGICAL RESEARCH AT THE CHALMERS UNIVERSITY OF TECHNOLOGY, GOTEBORG.
For primary bibliographic entry see Field 4C.
W79-05546

SOME RESULTS FROM URBAN RUNOFF STUDIES IN BERGSJON GOTEBORG,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Hydraulics.
For primary bibliographic entry see Field 2A.
W79-05548

APPLICATION OF HYDRAULIC AND HYDROLOGIC DATA IN URBAN STORMWATER MANAGEMENT,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-05588

SELECTED LOW-FLOW CHARACTERISTICS OF STREAMS IN THE VICINITY OF WARWICK, ORANGE COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
B. B. Eissler.
Geological Survey open-file report 78-811, 1978. 21 p, 1 fig, 3 tab, 5 ref.

Descriptors: *Low flow, *Streamflow, *Base flow, *New York, *Streams, Flow characteristics, Data collections, Flow rates, *Orange County(NY), *Warwick area(NY).

Base flows were measured during 1971-76 at 10 partial-record sites and three continuous-record stations on major streams in and bordering the town of Warwick, N.Y. Discharge measurements at the partial-record sites were correlated with records from three suitable continuous-record gaging stations near the town to determine 7-day, 2 year low flows and 7-day, 10-year low flows. Measurement-site descriptions are included. The information provides a data base that planners and managers can use in making water-management decisions. (Woodard-USGS)
W79-05595

REVIEW REPORT ON UMPQUA RIVER AND TRIBUTARIES, OREGON, INTERIM REPORT, SOUTH UMPQUA RIVER, VOLUME III; (APPENDIX B--HYDROLOGY, METEOROLOGY, AND RESERVOIR REGULATION; APPENDIX C--FOUNDATION AND MATERIALS DATA; APPENDIX D--RECREATION, PUBLIC USE, AND ENVIRONMENT),
Army Engineers District, Portland, OR.
For primary bibliographic entry see Field 8A.
W79-05616

STORMWATER INTERCEPTION AND STORAGE,
Hydroscience, Inc., Westwood, NJ.
D. M. Di Toro, and M. J. Small.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE1, Proceedings Paper 14368, p 43-54, February 1979. 7 fig, 2 tab, 18 ref, 2 append.

Descriptors: *Combined sewers, *Storm runoff, *Storm water, *Water storage, Statistical analysis, Water pollution, Water treatment, Retention, Interceptor sewers, Flow, Runoff, Model studies, Duration curves.

Stormwater control devices are constructed to intercept or to capture a portion of the design storm with a given runoff flow and duration. The portion will change, however, as the characteristics of the runoff vary from storm to storm. A statistical method of analysis was described. The method is based on a probabilistic characterization of rainfall and runoff, which evaluates the long-term performance efficiency of the devices. Stormwater control devices that capture and store runoff include interceptors and retention basins. The long-term average performance of interceptors and storage devices is determined based on the size and operational mode of the devices and the statistical properties of the runoff. Issues addressed included the effect of previous storms on storage, the emptying rate of the basin, flow variations between and within storms, the treatment implications of the first flush effect, and flow-concentration correlations. (Visocky-ISWS)
W79-05625

A STATISTICAL STUDY OF THE ANNUAL RAINFALL IN THE SUTLEJ CATCHMENT AND ANNUAL RUN-OFF AT BHAKRA DAM SITE,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 2B.
W79-05628

A STUDY OF LARGE FLOODS IN THE THAMBRAPARANI RIVER IN TAMIL NADU,
Observatory, New Delhi (India).
V. S. Rao, and C. Ramaswamy.
Indian Journal of Meteorology, Hydrology, and Geophysics, Vol. 27, No. 3, p 253-262, July 1976. 8 fig, 5 tab, 10 ref.

Descriptors: *Floods, *Precipitation excess, *Rainfall, Historic floods, Flash floods, Flood data, Hydrographs, Isohyets, Weather data, Runoff, Discharge(Water), Storms, Warning systems, Meteorology, Hydrology, *India, *Thambraparani River(India).

The paper contained an analysis of 16 synoptic situations during the period 1891-1960 (70 years) over and near the Gulf of Mannar in which prima facie, there could have been very heavy rain and consequent large floods in the Thambraparani River in the extreme south of the Indian Peninsula. It was found that there were only 3 situations in which 24-hour rainfall exceeding 200 millimetres at any one station in the river catchment was recorded. In all these 3 cases, there were large floods in that river. The basic synoptic causes for these 3 occasions of large floods were investigated in detail. Hydrological data pertaining to these 3 flood-situations were obtained from the Government of Tamil Nadu in the proforma prescribed by UNESCO for compiling information about catastrophic floods. Discharge-hydrographs based on the available data were prepared and studied. Isohyetal analysis for a one-day and two-day rainstorm was carried out. The hydrological characteristics of the floods so far as these could be determined from the available flood-data were discussed. All the 3 cases of large floods could be termed as 'flash floods'. The factors which led to the very heavy rainfall and flash floods were discussed from the point of view of issue of heavy rainfall and flood warnings on a quasi-empirical basis. (Sims-ISWS)
W79-05629

NITROGEN AND CHLORIDE MOVEMENT IN SMALL UPLAND PIEDMONT WATERSHEDS: II. NITROGEN AND CHLORIDE TRANSPORT IN RUNOFF,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 5B.
W79-05642

SPECIAL FLOOD HAZARD INFORMATION: TURKEY CREEK, BRYAN, TEXAS.
Prepared for the City of Bryan, Texas, December 1975, 17 p, 1 fig, 5 plates, 2 tab.

Descriptors: *Floods, *Texas, *Flooding, *Turkey Creek(TX), *Bryan(TX), *Flood protection, Runoff, Floodwater, Regional flood, Indirect flood measurement, Flood profiles, Historic floods, Flood stages, Peak discharge, Rivers, River beds, Floodways, Flood plains, Flood plain management, Flood plain zoning, Building codes, Land use, Planning, Zoning, Control structures, Floodproofing, 100-year flood, Flood data.

This report provides information about the flood potentials of 6.3 river miles of Turkey Creek and its South Fork in the vicinity of Bryan, TX, in Brazos County, about 70 miles northwest of Houston. Development in the flood plain is mainly agricultural. There are no stream gauging stations in the study area, and little specific data are available on past floods. Nearby Carters Creek appears to have experienced flooding in 1900, 1947, 1960, and 1973, and it is assumed flooding also occurred along Turkey Creek. Natural obstructions include trees, brush, and other vegetation in the floodway area. The 100-year flood would discharge 6,200 cubic feet per second (cfs) at London Bridge. No existing flood control structures exist on these two streams. A series of proposed guidelines for floodplain management include selective zoning measures which clearly define the floodway zone, subdivision regulations, changes in building codes to improve structural integrity, floodproofing, health regulations to control sewage disposal during floods, more accurate and timely forecasting of floods, and policies which discourage development in the floodway and the adjacent flood fringe. (Arnold-NC)
W79-05716

FLOOD PLAIN INFORMATION: MAXWELL CREEK, PARKER, TEXAS,
Army Engineer District, Fort Worth, TX.
Prepared for The City of Parker, Texas, February 1977. 34 p, 6 fig, 14 plates, 7 tab.

Descriptors: *Floods, *Flood stages, *Texas, *Peak discharge, *Flood plain management, *Flood protection, *Collin County(TX), *Maxwell Creek(TX), Flooding, Flood flow, Indirect flood measurement, Flood forecasting, Historic floods, Flood data, Flood frequency, Stage-discharge relations, Rivers, Flood plains, Non-structural alternatives, Flood plain zoning, Flood plain insurance, Building codes, Land use, Planning, Zoning, Control structures, Flow control, Floodproofing, Parker(TX), 100-year flood, 500-year flood.

This report presents the flood profile and potential flood hazards in the 10.52 square mile Maxwell Creek watershed in the vicinity of Parker, TX, northeast of the Fort Worth-Dallas metropolitan area. The flood plain is primarily undeveloped, with a few scattered residential sites. There are no stream gaging stations in the study area. However, U.S. Geological Survey stream gages in the Fort Worth-Dallas area were used for flood profiles for this study. Most flooding occurs in spring and fall, caused by heavy rains from storms and hurricanes. Obstructions include heavy tree, brush, and vegetation growth in the floodway. Four large floods occurred in 1968, 1969, 1971, and 1975. Estimated peak discharges at the downstream confluence with Small Tributary would be 11,300 cubic feet per second (cfs) for the 100-year flood, and 14,400 cfs for the 500-year flood. Recommended guidelines for flood plain management control include institution of regulatory measures, such as flood plain zoning, subdivision control ordinances, building and health codes; and establishment of nonregulatory measures, such as structural control barriers, fee purchase of flood plain lands for open space, acquisition of flooding easements, floodproofing, waterproofing and filling, establishment of a flood insurance program, and establishing development policies to control the extension of public services into flood hazard zones. (Arnold-NC)
W79-05719

FLOOD PLAIN INFORMATION: DEER CREEK AND TRIBUTARIES, CROWLEY, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for The City of Crowley, Texas, October 1977, 41 p, 7 fig, 25 plates, 7 tab.

Descriptors: *Texas, *Floods, *Flood profiles, *Flood stages, *Flood protection, *Flood plain management, *Crowley(TX), *Deer Creek(TX), Runoff, Regional flood, Indirect flood measurement, Flood forecasting, Historic floods, Flood data, Peak discharge, Flood peak, Non-structural alternatives, Flood plain zoning, Flood plain insurance, Warning systems, Building codes, Land use, Planning, Zoning, Control structures, Levee, Dikes, Dams, Tarrant County(TX), 100-year flood, 500-year flood.

The study area encompasses 18.1 miles of Deer Creek and its tributaries in the vicinity of Crowley, TX, just south of the Fort Worth-Dallas metropolitan area. Drainage area at the mouth of Deer Creek is 21.42 square miles. Average streambed slope varies from 20.7 feet/mile (at mouth of Deer Creek) to 75.3 feet/mile (at mouth of West Fork). The flood plains are primarily undeveloped, with a few scattered residential and commercial sites. Proximity to the City of Fort Worth will lead to intensified flood plain development. There are no stream-gaging stations in the area, although U.S. Geological Survey stream gages in the Fort Worth area were used for comparison purposes. Causes of flooding have been largely storms occurring in the spring and fall. Trees, brush, and debris are the chief impediments to floodflow. The most serious flooding occurred in spring 1949, 1957, and 1969. Peak discharges for the 100-year flood at the mouth of Deer Creek would be 19,700 cubic feet per second (cfs), and for the 500-year flood, peak discharge would be 25,700 cfs. There are no major flood damage prevention measures in the study area. Recommendations include establishment of flood plain regulatory measures, and nonregulatory measures such as acquiring flood plain lands for open space use and establishing a flood insurance program. The report is intended as an aid in planning the best use of flood-prone areas. (Arnold-NC)
W79-05720

MONITORING AREAWIDE RURAL WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W79-05842

CLASSIFICATION OF EVALUATION OF FLOOD FLOW FREQUENCY ESTIMATION TECHNIQUES,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen, and W. J. Rawls.
Water Resources Bulletin, Vol. 15, No. 1, p 88-93, February 1979. 19 ref.

Descriptors: *Flood frequency, *Application methods, *Data collections, Floods, Evaluation, Reviews, Model studies, Publications, Classification, Flow, Statistical methods, *Ungaged areas, Literature evaluation, Deterministic models, Calibrations.

Many procedures are available for estimating the magnitude and frequency of floods at ungaged locations. In selecting a procedure, a user considers the accuracy, reproducibility, and practicality of the available procedures. A classification system that groups the procedures according to important characteristics will be of great help to the user in selection of a suitable technique. The classification system, adapted by the Work Group on Flood Frequency Estimation at Ungaged Areas under the direction of the Hydrology Committee of the US. Water Resources Council, has 8 categories. It was recommended that the presentation of hydrologic studies should follow a consistant set of guidelines, including information relating to the accuracy, reproducibility, and practicality of the procedure used. Data requirements and the assumptions need to be clearly spelled out. (Singh-ISWS)
W79-05844

THE EFFECT OF THE SMALL-SLOPE APPROXIMATION AND LOWER BOUNDARY CONDITIONS ON SOLUTIONS OF THE SAINT-VENANT EQUATIONS,
Institute of Hydrology, Wallingford (England).
E. M. Morris.
Journal of Hydrology, Vol. 40, No. 1/2, p 31-47, January 1979. 10 fig, 13 ref.

Descriptors: *Hydrology, *Hydrographs, *Model studies, *Mathematical models, Equations, Streamflow, Runoff, Overland flow, Rainfall, Precipitation(Atmospheric), Froude number, Flow, Slopes, Watersheds(Basins), Mathematics.

A new, implicit, finite difference scheme was used to investigate the effect of the small slope approximation and the choice of lower boundary conditions on solutions of the Saint-Venant equations. It was found that for a range of values of the Froude and kinematic wave numbers, which covers most cases of hydrological interest, these factors have no significant effect on the depth and velocity profiles for surface flow. (Sims-ISWS)
W79-05938

TRANSLATORY CHARACTERISTICS OF THE MUSKINGUM METHOD OF FLOOD ROUTING,
Ahmadu Bellow Unv., Zaria (Nigeria), Dept. of Civil Engineering.
M. A. Gill.
Journal of Hydrology, Vol. 40, No. 1/2, p 17-29, January 1979. 4 fig, 1 tab, 12 ref.

Descriptors: *Flood routing, *Floods, *Flood waves, Storage coefficient, Hydrology, Hydraulics, Equations, Mathematical studies, Streams, Storage, Waves(Water), Analysis, *Muskingum method, Translatory characteristics, Sinusoidal flood.

Translatory characteristics of the routed flood waves using the Muskingum method were examined. It was possible to remove some ambiguities of the earlier work on the Muskingum method. Particularly for instance, the occurrence of the negative outflows during the time intervals 0 less than t less than k was explained as due to the use of wrong initial condition. As such, the method itself is free from this defect. (Lee-ISWS)
W79-05941

A SUMMARY OF MEASURED HYDRAULIC DATA FOR THE SERIES OF STEADY AND UNSTEADY FLOW EXPERIMENTS OVER UNIFORM GRASS ROUGHNESS,
Geological Survey, NSTL Station, MS. Water Resources Div.
D. L. Collins, and K. M. Flynn.
Geological Survey open-file report 78-808 (basic data), July 1978. 826 p, 2 fig, 66 tab.

Descriptors: *Flood plains, *Open channel flow, *Steady flow, *Unsteady flow, *Roughness(Hydraulic), Streambeds, Grassed waterways, Flow rates, Flow characteristics, Channel morphology, Elevation, Hydrographs, Hydrologic data, Analytical techniques, *Flood Plain Simulation Facility(MS), *Bay St. Louis(MS), Uniform grass roughness.

The measured hydraulic data collected in the Flood Plain Simulation Facility located at the Gulf Coast Hydroscience Center, near Bay St. Louis, Miss., are summarized for a series of experiments designed to study steady and unsteady flow over uniform grass roughness. All experiments were conducted during the 1973 and 1974 test seasons. Tables of measured ground-surface elevations, water-surface elevations, and point velocities are included for all experiments. A total of 19 steady flow experiments and 7 unsteady flow experiments for varying grass heights are included. The tabulated point velocities and water-surface elevations for

the unsteady flow experiments were selected to represent the general changes in the flow variables as the flood wave passed through the facility but do not include all collected data. However, all data that were collected have been stored on computer disk storage and may be retrieved using the listing programs and memory locations. (Woodard-USGS)
W79-05966

RESIDUE AND TILLAGE EFFECTS ON SCS RUNOFF CURVE NUMBERS,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
W. J. Rawls, and C. A. Onstad.
Paper No. 78-2505, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 18 p, 5 fig, 7 tab, 22 ref. ASAE, St. Joseph, Michigan.

Descriptors: Runoff, Surface runoff, Soil conservation, Till, Rainfall, Simulated rainfall, Estimating, Small watersheds, Corn(Field), Grains(Crops).

Data from 525 simulated and natural rainfall events were used to develop guides for estimating the effect of conservation tillage practices on the SCS runoff curve numbers for corn and small grain. The amount of residue on the ground or the percent of surface covered with residue was used to represent the effect of conservation tillage practices. (Skogerboe-Colorado State)
W79-05980

FLOOD-PLAIN DELINEATION FOR OCCOQUAN RIVER, WOLF RUN, SANDY RUN, ELK HORN RUN, GILES RUN, KANES CREEK, RACOON CREEK, AND THOMPSON CREEK, FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-05986

2F. Groundwater

EVALUATION OF PROPOSED TG AND E (TUCSON GAS AND ELECTRIC COMPANY) WASTEWATER DISCHARGE ON GROUNDWATER IN THE TUCSON BASIN,
Ground-Water Quality Consultant, Fresno, CA.
For primary bibliographic entry see Field 5E.
W79-05519

GROUNDWATER SAMPLING IN URANIUM RECONNAISSANCE,
Union Carbide Corp., Oak Ridge, TN. Nuclear Div.
For primary bibliographic entry see Field 5A.
W79-05521

HYDROLOGY AND WATER CONTROL ON LARGE PLAINS,
National Water Authority, Budapest (Hungary). Dept. of Water Resources Development.
For primary bibliographic entry see Field 2A.
W79-05526

GEOHYDROLOGICAL RESEARCH AT THE CHALMERS UNIVERSITY OF TECHNOLOGY, GOTEBORG.
For primary bibliographic entry see Field 4C.
W79-05546

ESTIMATION OF TRANSMISSIVITY AND PERMEABILITY IN SWEDISH BEDROCKS,
Chalmers Univ. of Technology, Goteborg (Sweden).
L. Carlsson, and A. Carlstedt.
In: Geohydrological Research at the Chalmers University of Technology, Goteborg; Papers Presented at the Nordic Hydrological Conference in Reykjavik, August 29 to September 1, 1976, p 42-54, May 1977. 6 fig, 4 tab, 14 ref.

Descriptors: *Transmissivity, *Permeability, *Bedrock, Specific capacity, Pumping, Wells, Water wells, Aquifers, Groundwater, Drawdown, Rocks, Foreign research, Sandstones, Limestones, Geology, Hydrogeology, *Sweden.

An estimation of the transmissivity and permeability in 4 different regions in Sweden with 7 different bedrocks was made from statistical analysis of pumped wells. The effect of well-loss in the calculation was treated theoretically. Of the investigated bedrocks, the permeability was highest in Cambrian and Algonkian sandstones. In the investigated crystalline Archean rocks, the gneisses seemed to have a better permeability than the granites, but the influence of the tectonic was very pronounced. (See also W79-05546) (Sims-ISWS)
W79-05551

INJECTION OF WATER INTO WELLS FOR INVESTIGATION OF LIMITED AQUIFER,
Chalmers Univ. of Technology, Goteborg (Sweden).
For primary bibliographic entry see Field 4B.
W79-05552

TRITIUM DATING OF SOME GROUNDWATER SAMPLES FROM NORTHWESTERN IRAQI DESERT,
Nuclear Research Inst., Baghdad (Iraq); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt).
A. S. Al-Badri, and F. M. Swailem.
Journal of the Geological Society of Iraq, Vol. 8, p 1-5, 1975. 2 tab, 9 ref.

Descriptors: *Radioactive dating, *Aquifer systems, *Groundwater movement, *Tritium, *Iraq, Base flow, Recharge, Water sources, Water wells, Hydrogeology, Chemical analysis.

The use of tritium, a radioactive isotope of hydrogen, in the determination of groundwater age, is an important and useful tool in the establishment of recharge source, interconnections of aquifers, groundwater flow patterns and aquifer parameters. The present study was carried out as a joint project by the Iraqi Atomic Energy Commission and the Middle Eastern Regional Radioisotope Center in the Rutba area to determine these characteristics of some selected groundwater samples from the northwestern desert area of Iraq. Preliminary to this analysis, three spiked samples of known tritium quantity were brought from the U.S. for calculation of an enrichment factor and old samples from an oil field were used for background measurements. Thirteen water samples were then collected from different wells within the study area. Two recent samples from the Euphrates River and a snowfall in the area of Rutba were analyzed as a reference for these samples. Results were tabulated by locality, date of collection, and tritium content. The average values of tritium content in the samples was found to be + or - 328 tritium unit and the water from the Tunif Well was found to be the oldest water in the area, indicating a distant recharge source. Water from Amig and Gadeed Wells was found to be old but mixed with some recent water, while samples from the Al-Mat and Al-Rutba Wells were established as being new and mainly fed from rainwater derived from Mullussa formation. Swab and Er-Radhuma water was also found to be recent but mixed with some old water. (Tickes-Arizona)
W79-05569

HYDROLOGIC DATA FOR THE ANTLERS AQUIFER, SOUTHEASTERN OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-05590

GROUND-WATER DATA ON THE HUDSON RIVER BASIN, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
D. S. Hammond, R. C. Heath, and R. M. Waller.
Geological Survey open-file report 78-710, 1978. 18 p, 2 fig, 1 plate, 1 tab, 30 ref.

Descriptors: *Groundwater resources, *Aquifers, *Groundwater availability, *Water quality, *Well data, Water wells, Water levels, Unconsolidated aquifers, Chemical analysis, Hardness(Water), Dissolved solids, Chlorides, Sulfates, Bicarbonates, New York, *Hudson River basin.

Ground water in the Hudson River basin occurs in unconsolidated deposits and consolidated rock. Sand and gravel units of the unconsolidated deposits, which occur principally in valley bottoms, form the best aquifers and commonly provide well yields of several hundred gallons per minute. Carbonate aquifers are the most productive consolidated rock units. Ground water in the Hudson River basin is generally hard and may contain appreciable amounts of iron, salts in solution, or sulfur locally. Basic data on the availability of ground water in the Hudson River drainage area are compiled in (1) a hydrogeologic map of the drainage basin; (2) a table of well depths, yields, concentrations of selected chemical constituents, and hardness of ground water, listed by county and aquifer type; (3) a short text describing the occurrence of ground water in the basin; and (4) a bibliography of ground-water reports pertinent to the area studied. (Woodard-USGS)
W79-05591

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE BOULDER--FORT COLLINS--GREELEY AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-05594

THE MISSISSIPPI RIVER VALLEY ALLUVIAL AQUIFER IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-05597

SELECTED WATER-LEVEL RECORDS FOR OKLAHOMA, 1975-1977,
Geological Survey, Okalhoma City, OK. Water Resources Div.; and Oklahoma Water Resources Board, Oklahoma City.
R. L. Goemaat, and D. E. Spiser.
Geological Survey open-file report 78-721, October 1978. 54 p.

Descriptors: *Oklahoma, *Water wells, *Water levels, *Aquifers, *Water level fluctuations, Basic data collections.

A systematic program to collect water-level records in Oklahoma began in 1937. The objectives of this program are (1) to provide long-term records of water-level fluctuations in representative wells, (2) to facilitate the prediction of water-level trends and indicate future availability of ground-water supplies, and (3) to provide information for use in basic research. This report includes a table of ground-water-level measurements in selected wells throughout Oklahoma for 1975-77. The data are subdivided by counties. (Woodard-USGS)
W79-05604

GROUND-WATER LEVELS AND QUALITY DATA FOR GEORGIA, 1977,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-05607

GROUND-WATER RESOURCES OF THE PAROWAN-CEDAR CITY DRAINAGE BASIN, IRON COUNTY, UTAH,

Geological Survey, Salt Lake City, UT. Water Resources Div.
L. J. Bjorklund, C. T. Sumsion, and G. W. Sandberg.
Utah Department of Natural Resources Technical Publication No. 60, 1978. 93 p, 17 fig, 8 plates, 10 tab, 44 ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Water yield, *Aquifer characteristics, *Water quality, Hydrogeology, Surface-groundwater relationships, Water supply, Water utilization, Water demand, Irrigation, Water wells, Water level fluctuations, Hydrologic budget, Hydrologic data, Hydrographs, Maps, *Utah, *Iron County(Utah), *Parowan-Cedar City drainage basin.

This report is intended to assist public officials and water users in the Cedar City-Parowan drainage basin, Iron County, Utah, to develop, conserve, and administer their water resources. The report primarily describes the ground-water resources in the alluvial fill of Cedar City and Parowan Valleys, but it also presents information about the water in the bedrock formations in the highlands surrounding the valleys. It discusses the relation of ground water to surface water in the basin and presents a general water-budget analysis. It includes information on the source, occurrence, availability, quantity, movement, chemical quality, and development of the ground water and the effects of climate, geology, and development on the resource. Ground-water development during 1940-74 has resulted in depressed water levels in most of Parowan and Cedar City Valleys. The estimated average annual depletion of the groundwater reservoir is about 3,600 acre-feet in Parowan Valley and 3,300 acre-feet in Cedar City Valley. Pumpage during 1974 amounted to approximately 73,000 acre-feet--30,700 in Parowan Valley and 42,300 in Cedar City Valley. The ground-water resource in the heavily pumped areas of the valleys should be regarded as fully developed so far as large discharges are concerned. Some additional development in outlying areas may be feasible. (Woodard-USGS)
W79-05608

THE TRANSMISSIVITY ITERATIVE CALCULATION ROUTINE--THEORY AND NUMERICAL IMPLEMENTATION,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resources Dept.
For primary bibliographic entry see Field 7C.
W79-05614

NITRATE MOVEMENT IN A CHILEAN AGRICULTURAL AREA IRRIGATED WITH UNTREATED SEWAGE WATER,
Chile Univ., Santiago. Dept. of Inorganic and Analytical Chemistry.
For primary bibliographic entry see Field 5B.
W79-05643

FEASIBILITY STUDY FOR DEVELOPMENT OF A TRANSIENT THREE-DIMENSIONAL GROUNDWATER FLOW MODEL UTILIZING THE FINITE ELEMENT METHOD,
Maryland Univ., College Park. Water Resources Research Center.
Karl Wesley Seckel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 268, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 51, 1978. 70 p, 7 fig, 54 ref. OWRT A-031-MD(2). 14-34-0001-7044.

Descriptors: Groundwater, Irrigation, Effluent disposal, *Groundwater flow, *Hydrologic models, *Porous media, Water table.

A transient three-dimensional groundwater flow model was developed from an already existing two-dimensional version. The finite element technique was used for the solution of the boundary value problem that governs flow in saturated-unsaturated porous media. Tetrahedral elements with linear interpolating polynomials were used in the finite element development. A feasibility study for a three-dimensional groundwater flow model was needed to determine if the model could be used to study water table fluctuations on a spray irrigation site in St. Charles, MD. The model considers precipitation, evaporation, transpiration, and the application of spray effluent in evaluating the hydrologic response of the irrigation fields. To provide efficient and effective wastewater treatment, the model could facilitate the design, operation, and maintenance of the spray irrigation facility. The theoretical basis for developing a three-dimensional groundwater flow model using the finite element technique seems to be valid, but the solution of the mathematical model did not yield valid results. The error resulted, most likely, from an invalid formulation of the computer algorithm solution of the mathematical model. Attempts to locate the cause and origin of the error were unsuccessful but simulation results indicate that the error may occur in the elemental finite element formulation. For future investigations the selection and utilization of higher ordered elements other than the tetrahedral element should be more flexible and more efficient. The finite element method is a very complex and powerful technique and should only be approached by well qualified investigators.
W79-05799

AN ANALYSIS OF THE GROUNDWATER RESOURCES OF TONGATAPU ISLAND, KINGDOM OF TONGA,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
B. Hunt.
Journal of Hydrology, Vol 40, No 1/2, p 185-196, January 1979. 7 fig, 2 tab, 7 ref.

Descriptors: *Groundwater, *Water resources, *Water quality, *Saline water-freshwater interfaces, Islands, Piezometry, Water levels, Observation wells, Recharge, Natural recharge, Artificial recharge, Model studies, Mathematical models, Saline water intrusion, Chlorides, *Tongatapu Island(Tonga), *Tonga.

An analysis was made of the groundwater resources of Tongatapu Island. The Ghyben-Herzberg approximation was used to estimate thicknesses of a freshwater lens floating on seawater. Finite-difference calculations were used to estimate rainfall recharge rates, and calculations were made to investigate the dispersion of chloride ions across the freshwater-salt-water interface. These calculations suggest that artificial recharge might be a useful device to control chloride concentrations in the freshwater aquifer. (Sims-ISWS)
W79-05827

POSSIBLE MECHANISMS FOR LEAKAGE BETWEEN AQUIFERS AND RIVERS,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, and L. M. Tomlinson.
Journal of Hydrology, Vol. 40, No. 1/2, p 49-65, January 1979. 14 fig, 10 ref.

Descriptors: *Model studies, *Aquifers, *Leakage, *Rivers, Base flow, Darcys law, Flow, Groundwater movement, Water levels, Limestones, Transmissivity, Pumping, Storage coefficient, Groundwater recharge, Water wells, Equations, Mathematical studies, Linearity, Hydraulic head.

Leakage between aquifers and rivers was studied using an idealized, one-dimensional problem. Various leakage mechanisms were introduced, and the effects on heads in the aquifer and flows to the river were noted. Leakage was represented by a linear coefficient, a non-linear coefficient, and combination of the two. Leakage also was modelled directly as a known flow. It was shown that base-flow recessions are effectively independent of the magnitude of the linear leakage coefficient. (Visocky-ISWS)
W79-05851

THE FLOW MECHANISM IN THE CHALK BASED ON RADIO-ISOTOPE ANALYSES OF GROUNDWATER IN THE LONDON BASIN,
Department of the Environment, Reading (England). Central Water Planning Unit.
R. A. Downing, F. J. Pearson, and D. B. Smith.
Journal of Hydrology, Vol. 40, No. 1/2, p 67-83, January 1979. 3 fig, 3 tab, 24 ref.

Descriptors: *Carbon radioisotopes, *Groundwater, *Radioactive dating, *Aquifers, Porosity, Permeability, Tritium, Groundwater movement, Flow, Carbonate rocks, Chemical precipitation, Carbonates, Joints(Geologic), Fissures(Geologic), *England, *Chalk aquifer, *London Basin, Matrix, Double porosity.

14C analyses of groundwaters from the Chalk of the London Basin were re-interpreted, and the age of the groundwater was revised. Radioiotope analyses were used to examine the flow mechanism in the aquifer. The evidence supported the view that a network of microfissures and larger intergranular pores in the matrix provides a signigficant part of the water pumped from Chalk wells and the major fissures distribute the water to the wells. Most of the matrix is fine-grained and contains a very old water. This diffuses into the microfissures and larger pores and is carried to the wells by the major fissures. (Visocky-ISWS)
W79-05852

EFFECT OF SEPTIC TANK EFFLUENT ON THE BASE STATUS OF TWO TILE-DRAINED SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W79-05945

AVAILABILITY OF GROUND WATER IN THE LOWER MERRIMACK RIVER BASIN, SOUTHERN NEW HAMPSHIRE,
Geological Survey, Concord, NH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-05968

GROUND-WATER DATA FOR 1976-77 IN JOSHUA TREE NATIONAL MONUMENT, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
D. J. Downing.
Availability: OFSS, USGS Box 25425, Den. Fed. Ctr. Denver, CO. 80225. paper copy $5.50, microfiche $3.50. Geological Survey open-file report 78-854, October 1978. 34 p, 2 fig, 4 tab, 4 ref.

Descriptors: *Groundwater resources, *Well data, *Water levels, *Water yield, *Water quality, Aquifers, Observation wells, Chemical analysis, California, National parks, *Joshua Tree National Monument.

A continuing study of ground water in Joshua Tree National Monument, Calif., shows that during 1976-77 water levels fluctuated seasonally; slight declines were detected in the Oasis of Mara and the Pinto Basin. Water quality was generally good, with a high concentration of fluoride in one well in the southern part of the Monument. (Woodard-USGS)
W79-05982

POTENTIOMETRIC SURFACE OF FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS, SEPTEMBER 1978,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-05983

2G. Water In Soils

EQUILIBRIUM AND ACTUAL EVAPOTRANSPIRATION FROM A VERY DRY VEGETATED SURFACE,
British Columbia Ministry of the Environment, Kamloops.
For primary bibliographic entry see Field 2D.
W79-05529

CONCENTRATION AND SIZE OF GRAVEL IN RELATION TO NEUTRON MOISTURE AND DENSITY PROBE CALIBRATION,
International Inst. of Tropical Agriculture Ibadan (Nigeria).
For primary bibliographic entry see Field 7B.
W79-05530

COMPARISON OF 2.8- AND 21-CM MICROWAVE RADIOMETER OBSERVATIONS OVER SOILS WITH EMISSION MODEL CALCULATIONS,
Regis Coll. Research Center, Weston, MA.
For primary bibliographic entry see Field 7B.
W79-05633

NITROGEN AND CHLORIDE MOVEMENT IN SMALL UPLAND PIEDMONT WATERSHEDS: I. NITRATE-NITROGEN AND CHLORIDE DISTRIBUTION IN SOIL PROFILES,
Southern Piedmont Conservation Research Center, Walkinsville, GA.
For primary bibliographic entry see Field 5B.
W79-05641

CATION EXCHANGE EQUILIBRIA IN A MIXED SOIL SYSTEM CONTAINING THREE HETEROVALENT CATIONS,
Texas Agricultural Experiment Station, Weslaco.
R. P. Wiedenfeld, and L. R. Hossner.
Soil Science Society of America Journal, Vol. 42, No. 5, p 709-712, September-October, 1978. 4 fig, 1 tab, 12 ref.

Descriptors: *Cation exchange, Chemical reactions, Thermodynamic behavior, Calcium, Magnesium, Sodium, *Soil chemistry.

Cation exchange equations used with soils have been suitable only for systems containing two cations. Theoretical exchange equilibria relationships were presented for a mixed soil system containing three heterovalent cations: Ca(2+), Mg(2+), and Na(+). Predictive equations for this tertiary system were derived using solid phase activity coefficients and thermodynamic equilibrium constants for the three binary systems obtained from experimental data. Theoretical cation exchange equilibria described for this tertiary system were in agreement with recognized exchange properties for these three cations. Interactions between two cations as they affect the exchange behavior of a third cation were also predicted. The methods presented are applicable to systems containing any number of heterovalent cations. (Skogerboe-Colorado State)
W79-05808

ELECTRON PROBE MICROANALYTICAL STUDIES OF PHOSPHORUS DISTRIBUTION WITHIN SOIL FABRIC,
West Pakistan Agricultural Univ., Lyallpur. Dept. of Soil Sciences.
R. H. Qureshi, D. A. Jenkins, and R. I. Davies.
Soil Science Society of America Journal, Vol. 42, No. 5, p 698-703, September-October, 1978. 4 fig, 13 ref.

Descriptors: *Phosphorus, Chemical analysis, *Soil analysis, Soil tests, Analytical techniques, Root zone, Iron, Nutrients.

Electron probe microanalysis was used to follow the distribution of phosphorus and associated elements within soil features to establish the composition of the immediate root environment. Various qualitative analytical modes of using the instrument were described involving either specimen traverse or spectrometer scanning with a static beam, line scanning, one-dimensional scanning, area scanning, or successive rast counting. By these means phosphorus was found to occur variously as discrete grains of rare-earth phosphates, in preferential association with iron in iron/manganese concretions, as concentrations within undifferentiated soil matrix and ferrans at void surfaces, and to be associated with calcium in a fresh root and possibly with iron rather than calcium, aluminum, or potassium in an old root. (Skogerboe-Colorado State)
W79-05809

ELECTRON PROBE MICROANALYSIS OF CALCITE GRAINS CONTAINING PHOSPHORUS IN SOIL,
West Pakistan Agricultural Univ., Lyallpur. Dept. of Soil Sciences.
R. H. Qureshi, and D. A. Jenkins.
Soil Science Society of America Journal, Vol. 41, No. 5, p 703-705, September-October, 1978. 4 fig, 11 ref.

Descriptors: *Calcite, *Phosphorus, Chemical analysis, Soil tests, Nutrients, *Soil analysis, Analytical techniques.

Calcite, comprising both clastic sand-sized grains and fossil foraminifera inherited from a marine Cretaceous (Gault) clay, was isolated from a haplaquept (gleyic brown calcareous earth) in the United Kingdom and shown by wet chemical analysis to contain an average of 0.3% phosphorus. Electron probe microanalysis indicated that this phosphorus is uniformly distributed within the calcite rather than concentrated as discrete calcium phosphates, and it was concluded that it was biogenic/diagenic rather than pedogenic in origin. Such sources were found to constitute 50-80% of the total soil phosphorus and thus suggested to be relatively available in the upper horizons of the profile. (Skogerboe-Colorado State)
W79-05810

DIELECTRIC CONSTANTS OF SOILS AT MICROWAVE FREQUENCIES--II,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
J. Wang, T. Schmugge, and D. Williams.
NASA Technical Paper 1238, May 1978. 32 p, 19 fig, 2 tab, 18 ref.

Descriptors: *Soils, *Microwaves, *Soil moisture, Soil types, Measurement, Frequency, Soil texture, Moisture, Mathematical studies, Sampling, Soil analysis, Slopes, Methodology, Soil water, Groundwater, Moisture content, Algorithms, Mathematics, Laboratory tests, Data collections, Soil dielectic constants.

The dielectric constants of several soil samples were measured at frequencies of 5 and 19 GHz using the infinite transmission line method. The results of these measurements were presented and discussed with respect to soil types and texture structures. A comparison was made with other measurements at 1.4 GHz. At all three frequencies, the dependence of dielectric constant on soil moisture can be approximated by two straight lines. At low moisture, the slope is less than at high moisture level. The intersection of the two lines is believed to be a function of soil texture. (Froehlich-ISWS)
W79-05861

2H. Lakes

MAJOR CHEMICAL CONSTITUENTS OF ARIZONA LAKES,
Arizona Univ., Tucson.
E. A. Stull, and S. J. Kessler.
Journal of the Arizona-Nevada Academy of Science, Vol. 13, No. 2, p 57-61, June 1978. 5 fig, 2 tab, 10 ref.

Descriptors: *Chemical analysis, *Chemical properties, *Arizona, *Lakes, *Lake morphology, Quantitative analysis, Sampling, Biochemistry, Microbiology, Lake basins, Chemical composition, Physical properties, Specific conductivity, Calcium, Magnesium, Alkalinity, Sulfates, Chlorides, Potassium, Silica, Watersheds(Basins).

Information on the major chemical constituents of Arizona lakes is important to the proper evaluation and understanding of these valuable water resources. The purpose of the present study was to determine and compare the major chemical constituents of 23 Arizona reservoirs selected to represent the diversity of Arizona waters and to suggest a correlation between these chemical compositions and the geographic patterns of Arizona's arid environment. Physical and chemical parameters of the 23 chosen reservoirs were surveyed twice during two fifteen-day periods in May-June and July, 1976. Specific conductance, calcium, magnesium, sodium, total alkalinity, sulfate, chloride, potassium and silica concentrations were determined in the laboratory 6 to 8 months after collection on unfiltered samples. Although results indicated the lakes to be chemically diverse, geographic trends in chemical concentration were clearly evident. The general pattern found was dilute lakes in the moist highlands and weakly saline lakes in the drier lowlands. It is concluded that a high proportion of the variance in the chemical concentration of Arizona lakes can be described by variables of climate and watershed morphology. (Tickes-Arizona)
W79-05567

EARTH DAMS AND RESERVOIRS,
Soil Conservation Service, Washington, DC. Engineering Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 770, Price codes: A04 in paper copy, A01 in microfiche. Technical Release No. 60, June 1976. 50 p, 8 fig, 9 tab.

Descriptors: *Earth dams, *Embankments, *Reservoirs, *Hazards, *Sedimentation, Design criteria, Spillway, Seismic design, Geologic investigations, Hydraulic structures, Flood control, *Hazard classes, Seismic assessments, Emergency spillwaYs.

The publication described design procedures and minimum requirements for planning and designing earth dams and associated spillways. The dams and reservoirs considered are larger than ordinary farm ponds. Dams were classified in 3 categories considering the hazard potential to property, communication lines, and human lives. Hydrology requirements and data were presented for each of the 3 hazard classes. Geologic investigation requirements were covered including seismic assessments. Earth embankments and foundations were described, including minimum factors of safety for embankment slope stability. Principal and emergency spillways, together with their hydraulic and structural design, also were included. (Singh-ISWS)
W79-05612

LAKE ERIE ICE: WINTER 1975-76,
National Oceanic and Atmospheric Administration, Rockville, MD. Environmental Science Information Center.
For primary bibliographic entry see Field 2C.
W79-05615

SNOW AND ICE IN THE PHOSPHORUS BUDGET OF A LAKE IN SOUTH CENTRAL ONTARIO,
Trent Univ., Peterborough (Ontario).
For primary bibliographic entry see Field 2C.
W79-05620

INERTIAL CURRENTS IN LAKE ONTARIO, WINTER 1972-73 (IFYGL),
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
G. O. Marmorino.
Journal of Physical Oceanography, Vol. 8, No. 6,

p 1104-1120, November 1978. 16 fig, 3 tab, 38 ref.

Descriptors: *Lake Ontario, *Great Lakes, *Currents(Water), Limnology, Stratification, Lakes, Hydrology, Winter, Frequency, Waves(Water), Ice, Ice cover, *Inertia currents(Water), Inertia oscillations, Hodographs, Internal-inertial waves, Vertical stratification, Oscillations.

Nearly 4 months of continuous current and temperature data, taken during the 1972-73 winter at depths of about 15 and 75 m in Lake Ontario, were analyzed for evidence of inertial oscillations. The data, collected as part of the International Field Year for the Great Lakes (IFYGL), were obtained at 9 stations: one near midlake, about 40 km from shore, and in about 140 m of water; the other 8 spaced around the lake, about 50 km apart, 12 km from shore and in 100 m of water. Inertial currents ocurred in episodes lasting less than 5 days and had speeds less than 15 cm per second. At the midlake and easternmost stations, the inertial currents accounted for as much as 10% (on average) of the total current variance. Some inertial events in midlake had no counterpart nearer shore. In contrast, a lakewide episode of inertial currents was induced by a storm during a two to three week period of vertical stratification. The average hodographs during the stratified period, calculated from bandpassed shallow currents, were ellipses with major axes oriented generally alongshore and axis ratios of 1.05 to 1.64. Some of the data can be interpreted in terms of internal-inertial waves with downward energy propagation and a vertical wavelength equal to the basin depth. Observed shifts to frequencies higher and lower than the inertial value were most likely caused by an interaction with lower frequency currents (Doppler effects). (Lee-ISWS)
W79-05634

A THREE-DIMENSIONAL MODEL OF LAKE ONTARIO'S SUMMER CIRCULATION, II. A DIAGNOSTIC STUDY,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. R. Bennett.
Journal of Physical Oceanography, Vol. 8, No. 6 p 1095-1103, November 1978. 6 fig, 11 ref. NOAA 03-5-002-57.

Descriptors: *Lake Ontario, *Great Lakes, *Model studies, Circulation, Numerical analysis, Currents(Water), Limnology, Hydrology, Summer, Lakes, Winds, Air circulation, *Two-layer circulation models, Lake circulation, Cyclonic circulation, Wind-driven current.

A two-layer circular lake model was used to study the mean flow of Lake Ontario during midsummer. By computing the model only to the second order of amplitude, it was shown that the observed cyclonic circulation of Lake Ontario during summer is due to the rectified effects of the large, transient, wind-driven currents. This effect is strongly influenced by model grid resolution and friction. (Lee-ISWS)
W79-05635

MIGRATING THERMAL STRUCTURE IN A FRESHWATER THERMOCLINE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
J. Lazier, and H. Sandstrom.
Journal of Physical Oceanography, Vol. 8, No. 6, p 1070-1079, November 1978. 5 fig, 1 tab, 13 ref.

Descriptors: *Lakes, *Canada, *Water temperature, *Model studies, *On-site investigations, Thermocline, Mathematical models, Freshwater, Temperature, Winds, Stratification, Theoretical analysis, On-site data collections, Depth, Profiles, Limnology, *Lake William(Nova Scotia).

The vertical migration of thermal structure in freshwater thermoclines was investigated with theory and observations. The theory was for the wind-forced internal oscillations of a viscous, non-rotating, long, narrow, lake of constant stratification. The introduction of viscosity resulted in a smooth phase change with depth near the nodes of the vertical displacement profiles. The gradual change of phase enabled the theory to model the observed vertical migration of the temperature structure created by the internal oscillations. The theory was compared to data obtained from a vertical array of thermistors moored in a stratified freshwater lake. Vertical phase profiles calculated from the thermistor chain data agreed well with the theoretical profiles for values of kinematic viscosity of about 0.000001 sq m/s. The amplitudes of the vertical displacement away from the nodes agreed reasonably well with values predicted by the theory. The agreement was sufficient to warrant the description of the migrating structures in terms of damped internal oscillations of the lake. (Sims-ISWS)
W79-05636

HYDROGEOLOGY AND COMPUTER MODEL OF THE BASS LAKE AREA, ST. CROIX COUNTY, WISCONSIN,
Department of Geology and Geophysics, University of Wisconsin-Madison.
M. B. Rinaldo-Lee, M. P. Anderson, D. A. Stephenson, and S. F. Huffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 457, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin, Technical Report WIS WRC 79-01, 1979. 48 p, 24 fig, 4 tab, 15 ref. OWRT A-075-WIS(1). 14-34-0001-7106, 14-34-0001-8053.

Descriptors: *Lakes, Dams, Hydrogeology, Groundwater, Flow, *Hydrologic model, Water levels, Bass Lake, Mounds Pond, Wisconsin.

Bass Lake is one of several lakes in northern Wisconsin where high water levels in the early 1970's caused flooding of homes. Because Bass Lake is a groundwater dominant lake with no inlet or outlet, it was speculated that high water levels were caused by increased groundwater discharge to the lake brought about by an impoundment, Mounds Pond, located 1.5 miles to the south and 12 feet higher than the normal elevation of Bass Lake. In order to determine probable cause of the high lake levels, an investigation into the hydrogeology of the area was initiated in the field. In addition to field data collection, a computer model was used to simulate the effects on the lake elevation of changing various parameters. Bass Lake appears to be influenced by both a regional flow-through and a local recharge system in the southern part of the lake and by a regional flow-through system in the northern part of the lake. Results of the field study indicate that there is no groundwater flow between Mounds Pond and Bass Lake. Computer model simulations indicated that lowering Mounds Pond by 10 feet, as was suggested as a means of alleviating the flooding at Bass Lake, would have no effect on Bass Lake levels. Results from computer model simulations designed to simulate the effects of an increase in recharge rate indicate that an increase in precipitation caused the abnormally high lake levels observed during the early 1970's. This conclusion was supported by an analysis of climatological data. Changes in lake level which coincide with changes in precipitation should be expected to occur in groundwater dominant lakes and allowances for fluctuations must be made when planning shoreline developments.
W79-05795

PREDICTING NIGHTTIME OXYGEN DEPLETION IN CATFISH PONDS,
Auburn Univ., AL. Water Resources Research Inst.
R. P. Romaire, and C. E. Boyd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 266, Price codes: A03 in paper copy, A01 in microfiche. Agricultural Experiment Station Bulletin 505, September, 1978, 32 p. OWRT A-066-ALA(2).

Descriptors: *Dissolved oxygen, *Catfish, Aeration, Ponds.

Inadequate concentration of dissolved oxygen (DO) has long been recognized as a critical factor in the intensive production of channel catfish (Ictalurus punctatus) in ponds. Emergency aeration should be initiated in ponds when the DO concentration declines to less than 2.0 parts per million (ppm). Presently, fish culturists have no reliable technique for predicting if DO will fall below this critical level during the night. Emergency aeration is frequently used when not required, and in some cases, it is not used when needed. The data herein provide the culturist with two practical methods for predicting at dusk (or shortly thereafter) if DO depletion is likely to occur in a pond during any given night, thereby allowing time to prepare for emergency aeration.
W79-05800

LONGSHORE TRANSPORT AT A TOTAL LITTORAL BARRIER,
Coastal Engineering Research Center, Fort Belvoir, VA.
R. O. Bruno, and C. G. Gable.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 473, Price codes: A02 in paper copy, A01 in microfiche. Reprint 77-6, July 1977. 19 p, 10 fig, 2 tab, 7 ref.

Descriptors: *Currents(Water), *Beaches, *Littoral drift, *California, *Beach erosion, *Sediment transport, Waves(Water), Harbors, Breakwaters, Analysis, Hydrography, On-site investigations, Coastal processes, Longshore currents.

Analysis of longshore transport at a littoral barrier was presented. Channel Islands Harbor, California, was selected as the study site because its offshore breakwater and jetties form a unique complete littoral barrier. Through repetitive surveys, an accurate determination of longshore material transport in one direction was made. Measured transport rates ranged from 160,000 to 1,284,000 cubic meters per year. Utilizing visual observations of surf parameters, estimates of longshore wave thrust were computed. The range of wave thrust was 145 to 1,988 newtons per meter. Comparison of the relation of wave thrust and longshore sediment transport was made. This study indicated that in an environment of high transport, nearly twice as much transport is predicted under corresponding wave thrust as that of the data summarized in the Coastal Engineering Research Center's Shore Protection Manual. (Adams-ISWS)
W79-05838

APPLICATION OF RIDGE REGRESSION ANALYSIS TO WATER RESOURCES STUDIES,
Agricultural Research and Education Center, Belle Glade.
For primary bibliographic entry see Field 2A.
W79-05853

ASSESSMENT OF A COOLING LAKE ECOSYSTEM,
Wisconsin Univ.-Madison. Lab. of Limnology.
S. J. Lozano, D. W. Rondorf, and J. F. Kitchell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 537, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin, Technical Report, 1978. 109 p, 49 fig, 12 tab, 107 ref. OWRT A-070-WIS(3). 14-34-0001-6052, 14-34-0001-7105, 14-34-0001-7106.

Descriptors: *Water cooling, Limnology, Biological communities, Primary production, *Lakes, Phytoplankton, Aquatic life, Lake Columbia, Wisconsin.

Primary production, aquatic invertebrates, and fish were studied during 1975-1977 to determine responses of organisms to a 15C temperature gradient in a 190-hectare diked cooling lake, Lake Columbia, WI. The relative importance of macrophytes, periphyton, and phytoplankton production to primary production of the cooling lake is discussed. Seasonal and spatial changes in species composition of periphyton are shown. Field and

laboratory studies of invertebrate distribution, growth, and reproduction show evidence that modified life history and temperature directed movement are two important mechanisms by which invertebrates change their distribution in a heterothermal environment. Distribution of Hyalella azteca, a stenothermal amphipod, and reproductive responses of two eurythermal ostracods, the parthenogenetic Cypirdopsis vidua and the syngamic Physocypria pustulosa, were studied. Species diversity, distribution, growth, and reproductive responses of fish in a newly impounded cooling lake are described. Simple models are used to describe relative abundance and aggregation of fish relative to water temperature during a summer and winter. The importance of temperature changes, caused by spring power plant shutdowns, to the temporal placement of spawning, duration of spawning, and apparent reproductive success as determined by sampling adult and larval fish is shown for black crappie, Pomoxis nigromaculatus, and white bass, Morone chrysops. From these studies site specific and general management strategies were formulated.
W79-05964

2I. Water In Plants

SALT TOLERANCE IN THE WILD RELATIVES OF THE CULTIVATED TOMATO: RESPONSES OF SOLANUM PENNELLII TO HIGH SALINITY,
Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Biology.
K. Dehan, and M. Tal.
Irrigation Science, Vol. 1, No. 1, p 71-76, August, 1978. 5 tab, 12 ref.

Descriptors: *Salt tolerance, Salinity, *Tomatoes, Moisture deficit, Ions.

The cultivated tomato Lycopersicon esculentum, cultivar Rheinlands Ruhm, and the wild species Solanum pennellii accession Atico, were compared with respect to their salt tolerance. The wild species was more salt tolerant than the cultivated tomato. In contrast to L. esculentum plants, the growth of the wild species was not impaired by the high salinity, although the latter accumulated more Cl(-) and Na(+) ions and its K+ level decreased under salinity. The smaller increase in water deficit under salinity in the wild species was attributed to its higher accumulation of ions. (Skogerboe-Colorado State)
W79-05813

THE EFFECT OF SUPPLEMENTAL IRRIGATION AND NITROGEN FERTILIZATION ON WHEAT (TRITICUM AESTIVUM L.),
Agricultural Research Organization, Gilat (Israel). Regional Experiment Station.
D. Shimshi, and U. Kafkafi.
Irrigation Science, Vol. 1, No. 1, p 27-38, August, 1978. 2 fig, 7 tab, 13 ref.

Descriptors: *Irrigation effects, Fertilization, Nitrogen, *Wheat, Crop response, Crop production, Growth stages.

During 1971-72 an experiment was conducted at the Gilat Regional Experiment Station in the Negev region of Israel, in which the combined effect of irrigation and nitrogen fertilizer on wheat was studied. The following aspects were investigated: the general nature of the interaction of irrigation and nitrogen on crop yields and the effect of nitrogen on water use and water relations of the wheat plant. (Skogerboe-Colorado State)
W79-05817

WATER RELATIONS OF CADMIUM-TREATED PLANTS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
M. B. Kirkham.
Journal of Environmental Quality, Vol. 7, No. 3, p 334-336, July-September, 1978. 2 fig, 1 tab, 21 ref.

Descriptors: *Turgidity, Water pressure, Osmotic pressure, *Cadmium, *Transpiration, Soil-water-plant relationships.

Turgor pressures, stomatal resistances, and transpiration rates were measured during a 50-day period in leaves of chrysanthemum (Chrysanthemum morifolium Ramat. 'Indianapolis White') plants grown in nutrient solution with 0, 0.01, 0.1, and 0.0 microgram/ml Cd added as CdSO4. At harvest, dry weight and Cd concentrations in roots, stems, and leaves were determined. Leaf abscission occurred on Cd-treated plants. Turgor pressures were highest in plants grown with 0.01 microgram/ml Cd and lower in plants treated with 0, 0.1, and 1.0 microgram/ml Cd. Stomatal resistances were lowest in plants grown with 0.01 microgram/ml Cd and progressively higher in plants treated with 0, 0.1, and 1.0 microgram/ml Cd. Results indicated that quantities of Cd permitted in irrigation water in the United States (0.05 microgram/ml) might be detrimental to growth because of reduced turgor pressure and increased stomatal resistance. (Skogerboe-Colorado State)
W79-05934

GROWTH AND ELEMENTAL COMPOSITION OF CORN AND BEAN SEEDLINGS AS INFLUENCED BY SOIL APPLICATION OF COAL ASH,
Savannah River Ecology Lab., Aiken, SC.
For primary bibliographic entry see Field 5B.
W79-05942

THE UPTAKE OF 203HG-LABELED MERCURY COMPOUNDS BY BROMEGRASS FROM IRRIGATED UNDISTURBED SOIL COLUMNS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W79-05943

2J. Erosion and Sedimentation

PREDICTING SAND DEPOSITION AT POROUS FENCES,
B. P. Petroleum Development Ltd., Aberdeen (Scotland).
C. J. Phillips, and B. B. Willets.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW1, Proceedings Paper 14379, p 15-31, February 1979. 15 fig, 1 tab, 13 ref, 2 append.

Descriptors: *Dune sands, *Wind erosion, *Erosion control, *Model studies, Laboratory tests, Mathematical models, Sands, Dunes, Erosion, Sedimentation, Sediment transport, Winds, Coasts, Beaches, Stabilization, Coastal engineering, Sand fences.

For porous fences of limited height and 'infinite' length, measurements of boundary shear stress were reported in air flow normal to the fence plane. On the assumption that boundary shear stress is similarly distributed in sand-laden flow, calculations were made of the growth of a dune near a fence placed normal to the transport direction of sand. Although based on formulas developed for circumstances of uniform flow and transport rate, the calculations were reasonably successful when compared with small-scale wind-tunnel experiments. It was shown that the effect of jetting through fence gaps should be allowed for in calculations and that this can be done quite simply, and also that each sand (and by implication each sand condition) requires its own transport rate formula. Grain collisions with fence members and the effect of probable miscalculation of characteristic path length were examined but not resolved. (Sims-ISWS)
W79-05533

STATISTICAL ANALYSIS OF CONCENTRATION RECORDS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
J. C. Willis, and G. C. Bolton.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, Proceedings Paper 14310, p 1-15, January 1979. 13 fig, 1 tab, 10 ref, 2 append.

Descriptors: *Bed load, *Sediments, *Statistical methods, Analytical techniques, Data processing, Laboratory tests, Flumes, Sands, Sediment transport, Statistics, Turbulence, Suspended solids, Hydraulics, *Sediment concentration, Statistical analysis.

A time-series analysis of continuous records of total discharge concentration of bed material from tests in a laboratory flume defined experimental values of the mean statistical parameters (mean concentration, standard deviation of the concentration fluctuations, and mean spectral frequency) as well as the probability and spectral distribution functions. The mean concentration and standard deviation were closely related only to the Froude number of the flow, but the mean spectral frequency and the normalized spectra and probability functions exhibited additional variability that may be attributed to a combined influence of water temperature and flow variables. That the mean concentration was only about 1.6 times the standard deviation illustrated the extreme variability of concentration data. (Sims-ISWS)
W79-05535

EFFECTS OF HINDERED SETTLING ON SEDIMENT CONCENTRATION PROFILES,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. W. Lavelle, and W. C. Thacker.
Journal of Hydraulic Research, Vol. 16, No. 4, p 347-355, 1978. 4 fig, 1 tab, 13 ref.

Descriptors: *Sediments, *Suspended solids, *Settling velocity, *Model studies, Mathematical models, Laboratory tests, Flumes, Bed load, Bottom sediments, Turbulence, Diffusivity, Mixing, Sedimentology, *Sediment concentration.

Suspended sediment distributions which take into account concentration-dependent settling velocities were derived. The distributions were compared with the high concentration data of Einstein and Chien and were found to be in good agreement. The analysis showed that concentrations at the sediment bed in the Einstein-Chien data were close to those of saturated sediments, which leads to the suggestion that the reference level in the distributions always should be taken at the bed where the reference concentration is flow independent. A suspended sediment distribution constructed in this way guarantees a reasonable value for concentration near the bed and depends on two diffusivity parameters which the Einstein-Chien concentration data indicate are related. (Sims-ISWS)
W79-05542

ARID GEOMORPHOLOGY,
Oxford Univ. (England).
A. Goudie.
Progress in Physical Geography, Vol. 2, No. 2, p 333-338, 1978. 44 ref.

Descriptors: *Geomorphology, *Land forms, *Earth-water interfaces, Fluvial sediments, Erosion, Geophysics, Arid lands, Solar radiation, Aeolian soils.

Concepts relating to development of desert landscapes by wind erosion, water action, and mechanical weathering have undergone much debate over the last two decades. The generally accepted view during the 19th century that desert landforms were produced largely by mechanical weathering and wind action, was largely replaced during the 20th century by laboratory simulation studies indicating the predominant force in desert creation to be water action. Although insolation weathering and wind erosion are perhaps not the principal

forces, further developments have again occurred in the 1970s to indicate that both deserve more respectful attention in considering the general concept of arid geomorphology. The author urges geomorphologists to disregard wind and water as opposites and consider more seriously the contribution eolian materials make to fluvial sedimentation and conversely, that fluvial materials made to eolian deflation. (Tickes-Arizona)
W79-05558

DUST STORMS AND THEIR GEOMORPHOLOGICAL IMPLICATIONS,
Oxford Univ. (England). School of Geography.
A. S. Goudie.
Journal of Arid Environments, Vol. 1, No. 4, p 291-310, December 1978. 6 fig, 10 tab, 143 ref.

Descriptors: *Dust storms, *Wind erosion, *Erosion rates, *Sediment transport, *Geomorphology, *Environmental effects, *Fluvial sediments, Aeolian soils, Eluvium, Loess, Soil erosion, Particle size, Soil stabilization, Sediment load, Glacial sediments, Soil formation, Water quality, Moisture deficit, Frequency analysis, Precipitation(Atmospheric), Meteorology, Climatology, Groundwater, Depression.

Dust storms, common phenomena in many parts of the world, are especially apparent in arid regions where they represent the result of a substantial degree of deflation and erosion. The numerous environmental consequences of these storms include their effects on climatic change, ocean sedimentation, soil formation, groundwater quality, crop growth, and glacier ice quality. The purpose of this study was to analyze the frequency of dust storms, their distribution, rate of deposition, amount of erosion, and the nature of the materials laid down by them with particular attention to occurrences in arid regions of the Middle East, India, China, and the U.S.S.R. Although the role of wind as a geomorphic agent has frequently been minimized, it is suggested here that dust storms in arid regions occur with considerable frequency and areal extent. Principal factors appearing to control dust storm generation are quantity of precipitation, which largely effects the degree of vegetative cover and soil moisture characteristics, wind velocity, and source of material. Dust deposition rates are substantial not only at desert margins but also at greater distances into the non-arid regions where data suggest that rates of aeolian accumulation may be as high as fluvial erosion rates. Data for both individual and generalized storms are presented and results of chemical and grain size analysis reviewed. (Tickes-Arizona)
W79-05559

GRANULAR MEDIA FILTRATION OF DREDGING EFFLUENTS,
Northwestern Univ. Evanston, IL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W79-05621

PHYSICAL OCEANOGRAPHY OF THE MIDDLE ATLANTIC BIGHT,
Woods Hole Oceanographic Institution, MA.; Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.; and National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
R. C. Beardsley, W. C. Boicourt, and D. V. Hansen.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.). American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 20-34, 1976. 4 fig, 3 tab, 39 ref. Allen Press, Inc., Lawrence, Kansas.

Descriptors: *Baseline studies, *Oceanography, *Ocean circulation, Water quality, Sediment transport, Water pollution, *Outer Continental Shelf, *New York Bight.

Kinetic energy spectra from moored current meters in the mid-Atlantic Bight reveal marked differences in current variability between the inner shelf and the outer shelf and slope regions. The nearshore subtidal current variability appears to be dominated by meteorological forcing. The amplitude of the semidiurnal and diurnal tidal peaks decreases in the offshore direction. Shallow water records show little or no inertial energy, while at the shelf break and over the slope, inertial motion contributes significantly to the current variance. A simple coneptual model is presented to explain how intense winter low pressure systems ('northeasters') drive strong alongshore currents which are coherent over much of the bight. A map of 'mean' currents measured in recent moored array experiments demonstrates subsurface water flow along the shore toward the southwest. The average currents generally increase in magnitude offshore and decrease with closeness to bottom. At most sites, the mean current veers toward shore with increasing depth. The alongshore volume transport measured at three transects across the bight shows surprising uniformity, considering the possible sources for discrepancy. This transport of water within the 100-m isobath implies a mean residence time of the order 3/4 year. Much of the shelf water observed flowing westward south of New England must originate in the Gulf of Maine-Georges Bank area. (Sinha-OEIS)
W79-05680

NEW YORK BIGHT WATER STRATIFICATION--OCTOBER 1974,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 1A.
W79-05682

MORPHOLOGIC EVOLUTION AND COASTAL SAND TRANSPORT, NEW YORK--NEW JERSEY SHELF,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
D. J. P. Swift, G. L. Freeland, P. E. Gadd, G. Han, and J. W. Lavelle.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 69-89, 1976. 19 fig, 36 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Baseline studies, *Sediment transport, *Sedimentation, Erosion, Environmental effects, Geomorphology, *Outer Continental Shelf, *New York Bight, Nearshore processes, Estuarine processes, Coastal morphology.

The surface of the New York-New Jersey shelf has been extensively modified by landward passage of nearshore sedimentary environments during the postglacial rise of sea level. The retreat of estuary mouths across the shelf surface has resulted in shelf valley complexes. Constituent elements include shelf valleys largely molded by estuary mouth scour, shoal retreat massifs left by the retreat of estuary mouth shoals, and midshelf or shelf-edge deltas. The erosional retreat of the straight coast between estuary mouths has left a discontinuous sheet of clean sand 0-10 cm thick. During the retreat process, a sequence of oblique-trending, shoreface-connected sand ridges formed at the foot of the shoreface. As a consequence, the surficial sand sheet of the shelf floor bears a ridge and swale topography of sand ridges up to 10 m high and 2-4 m apart. The mechanics of sedimentation in these two nearshore environments (estuary mouth and interestuarine coast) are now being invested for purposes of environmental management as well as for further understanding of shelf history. Systematic observations of sedimentation in New York Harbor mouth have not yet been initiated. However, reconnaissance data reveal a complex pattern of ebb- and flood-dominated zones that control the pattern of sand storage. (Sinha-OEIS)
W79-05684

SUSPENDED PARTICULATE CONCENTRATIONS AND COMPOSITIONS IN THE NEW YORK BIGHT,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 5C.
W79-05687

DEVELOPMENTAL TESTS ON THE USE OF FLUORESCENT TRACERS AND BACKWASH SEDIMENT-LOAD SAMPLERS TO MEASURE THE BEACH DRIFT COMPONENT OF LITTORAL TRANSPORT AT SANDY HOOK, NEW JERSEY,
Teachers Coll., New York. Dept. of Science Education.
W. E. Yasso.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 138-149, 1976. 6 fig, 3 tab, 7 ref. Allen Press Inc., Lawrence, Kansas. ONR-NR-388-057.

Descriptors: *Baseline studies, *Sediment transport, *Littoral drift, *Erosion, Sedimentation, Beach erosion, Environmental effects, Water resources, *Outer Continental Shelf, *New York Bight.

Simple, flat-bottomed, troughlike devices made of sheet metal were used to sample bedload and suspended load of individual backwashes in time-integrated studies of beach drift rate on the foreshore at Sandy Hook, New Jersey. In the most complete experiment first arrival of fluorescent tracer particles, in the medium to coarse sand range, showed a negative linear relationship between particle diameter and beach drift velocity. Peak-of-distribution arrivals, based on smoothed recovery distributions obtained by weight ratio conversion procedures, confirm the inverse sediment size-beach drift velocity relationship. Increase in mean backwash sediment mass is roughly correlated with increase in the product of breaker height squared and breaker period squared. However, both this relationship and the anomalous variability and apparent periodicity in sediment mass entrained by individual backwashes will require further investigation. (Sinha-OEIS)
W79-05688

FREQUENCY AND EXTENT OF WIND-INDUCED RESUSPENSION OF BOTTOM MATERIAL IN THE U.S. GREAT LAKES NEARSHORE WATERS,
Wisconsin Univ., Madison. Water Resources Center.
V. P. Kozak, and G. V. Simsiman.
International Joint Commission, International Reference Group on Great Lakes Pollution from Land Use Activities, Technical Report for U.S. Task Force D, June 1978. 111 p, 34 fig, 26 tab, 74 ref, 7 append. EPA 68-01-1598.

Descriptors: *Reviews, *Winds, *Resuspension, *Bottom sediments, *Great Lakes, *Nearshore zones, *Water pollution sources, *Path of pollutants, *Sedimentation, Sediments, Lakes, Lake Erie, Lake Michigan, Lake Huron, Lake Ontario, Lake Superior, Waves, Soil erosion, Land use, Research priorities, International Joint Commission.

An extensive literature review was conducted to determine the frequency and extent of wind-induced resuspension of bottom sediments in the U.S. Great Lakes nearshore zones, and to identify nearshore areas where sediment characteristics and wind/wave conditions are especially conducive to seasonally periodic bottom sediment resuspension. Wind and wave characteristics and properties of nearshore surficial sediments were two major areas explored, and limited information on critical velocities and entrainment was evaluated. The magnitude of sediment resuspension was closely related to frequency (days/yr) of occurrence of strong wind-generated waves. Sediment type also had a strong influence on resuspension, as demonstrated in Lake Erie's western basin, dominated by fine

ediments, where larger amounts of sediments are esuspended than in central and eastern areas, de-pite the greater probability of resuspension in the atter areas based on hydrodynamic considerations. Predicted sediment resuspension quantities from his study were about as great as indicated by data rom limited field observations. Ranking of near-hore areas by quantity of resuspended sediment orrelates well with ranking obtained by resuspen-ion frequency for lakes Michigan and Ontario. High sediment resuspension potential was found or nearshore areas of eastern Lake Ontario, east-rn and southern Lake Michigan, Saginaw Bay and St. Clair River areas of Lake Huron, and east- and west-central Lake Superior. Additional research eeds are identified. (Lynch-Wisconsin)
W79-05736

SUBSURFACE DRAINAGE MODEL WITH ASSOCIATED SEDIMENT TRANSPORT,
Florida Univ., Gainesville.
A. B. Bottcher, E. J. Monke, and L. F. Huggins.
Paper No. 78-2502, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 21 p. 4 fig, 15 ref, ASAE, St. Joseph, Michigan.

Descriptors: *Subsurface drainage, *Model studies, Computer models, Sediment transport, Simulation analysis, Tile drainage, Sediment yield, Flow rates.

A computer model was developed, using the GASP IV simulation language to simulate the water flow and sediment movement from a subsurface drainage system. The model uses a one dimensional form of the Richard's Equation and a steady state tile flow formula by Toskoz and Kirkham to express the water movement process. The particle detachment model, which is based on a force balance relationship, is driven directly by the output of the flow model. Data required by the model includes rainfall, evapotranspiration, soil properties, and the drainage system layout. Calibration and verification was completed using data collected from a seventeen hectare tile drainage system located on a flat Hoytville silty clay soil. A comparison of the simulated and observed results indicate that the model wil reliably predict water yield, sediment yield and the sediment concentration curve. The model had difficulty in simulating the actual shape of the flow hydrograph. (Skogerboe-Colorado State)
W79-05802

EROSION CONTROL/SEDIMENT MODELING--SOUTHERN IDAHO A PROGRESS REPORT,
Idaho Agricultural Experiment Station, Aberdeen.
T. S. Longley.
Paper No. 78-2028, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 6 p, 3 fig, 4 ref, ASAE, St. Joseph, Michigan.

Descriptors: *Soil erosion, Agricultural watersheds, *Sediment load, Return flow, Idaho, Irrigation, Model studies.

The progress of erosion control/sediment modeling was reported. The modeling effort proceeded in three steps: (1) the furrow erosion submodel, (2) the instream erosion control practice submodel, and (3) the routing model to route the water down through the watershed. The furrow erosion submodel predicts the sediment lost from an individual field using furrow hydraulic parameters and the stream power concept. The instream erosion control practice submodel predicts the effectiveness of the best management practices in cleaning the sediment from the return flow, and finally a routing procedure is used to move the flow and associated sediment through the watershed. (Skogerboe-Colorado State)
W79-05804

LONGSHORE TRANSPORT AT A TOTAL LITTORAL BARRIER,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2H.
W79-05838

THE SUSPENDED SEDIMENT REGIME OF AN OREGON COAST RANGE STREAM,
Pacific Northwest Forest and Range Experiment Station, College, AK. Alaska Region.
S. J. Paustian, and R. L. Beschta.
Water Resources Bulletin, Vol. 15, No. 1, p 144-154, February 1979. 4 fig, 1 tab, 21 ref.

Descriptors: *Oregon, *Suspended solids, *Streams, Sediment transport, Streamflow, Storms, Winter, Forest watersheds, Hydrology, Runoff, Streambeds, Mountains, Seasonal, Discharge(Water), Suspended load, *Mountain streams, Sediment-discharge relationship, Storm-generated runoff.

Armored stream segments may affect the suspended sediment regime of small mountain streams in western Oregon by the release of fine sediments stored in the bed gravels. Sieve analysis of bed materials indicated that at least 30% of the suspended sediment yield for the 1975-76 winter had been stored in the streambed. Suspended sediment concentrations during storm-generated runoff were influenced by stream discharge and hydrograph characteristics. Sediment-discharge relations for individual storms were characterized by hysteresis loops. A seasonal flushing of fines was shown by a progressive decrease in the ratio of suspended sediment to stream discharge during the winter runoff period. (Lee-ISWS)
W79-05846

QUANTITATIVE ANALYSIS OF AIRCRAFT MULTISPECTRAL-SCANNER DATA AND MAPPING OF WATER-QUALITY PARAMETERS IN THE JAMES RIVER IN VIRGINIA,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
For primary bibliographic entry see Field 7B.
W79-05862

PLANT COMMUNITIES OF ALASKAN ARCTIC BEACHES,
Western Washington Univ., Bellingham.
For primary bibliographic entry see Field 5C.
W79-05910

NUTRIENT DYNAMICS IN NEARSHORE UNDER-ICE WATERS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 5C.
W79-05920

2K. Chemical Processes

ACID PRECIPITATION IN THE NEW YORK METROPOLITAN AREA: ITS RELATIONSHIP TO METEOROLOGICAL FACTORS,
Interstate Sanitation Commission, New York.
G. T. Wolff, P. J. Lioy, H. Golub, and J. S. Hawkins.
Environmental Science and Technology, Vol. 13, No. 2, p 209-212, February 1979. 5 fig, 2 tab, 18 ref.

Descriptors: *Precipitation(Atmospheric), *Acids, *Hydrogen ion concentration, *New York, Rainfall, Snowfall, Sampling, Winds, Storms, Summer, Winter, Spatial distribution, Temporal distribution, Weather, Air pollution, Meteorology, *Acid precipitation.

A study which examined the spatial, meteorological and seasonal factors associated with precipitation pH in the New York Metropolitan Area has been completed. From 1975 through 1977, 72 events were studied. Among the 8 sites in the study, there was some site-to-site variability. The mean pH was 4.28, and the lowest seasonal values occurred during the summertime. The storms were classified according to type for each event, and showers and thundershowers associated with cold fronts and air masses yielded the lowest pHs of 4.17 and 3.91, respectively. Closed low-pressure systems produced somewhat higher values. Air parcel trajectory analyses showed that these air mass and frontal storms were generally associated with winds from the west and southwest. These are the directions from which high emissions in the Northeast have their greatest impact on the New York Metropolitan Area. (Sims-ISWS)
W79-05626

AMMONIA VOLATILIZATION LOSSES FROM FLOODED RICE SOILS,
International Rice Research Inst., Los Banos, Laguna (Philippines). Dept. of Agronomy.
D. S. Mikkelsen, S. K. De Datta, and W. N. Obcemea.
Soil Science Society of America Journal, Vol. 42, No. 5, p 725-730, September-October, 1978. 8 fig, 10 ref.

Descriptors: *Nitrogen, Volatility, Hydrogen ion concentration, Ammonia, Submerged plants, Fertilization, Rice.

The pH of the flood water in rice fields is largely determined by the chemical equilibria that exist between the CO2 balance achieved by the aquatic biota and the various solutes, solids, and gases in the water. Water pH values undergo diurnal changes, increasing by midday to values as high as pH 9.5-10 and decreasing as much as 2-3 pH units during the night. The pH of shallow flood water is greatly affected by the total respiration activity of all the heterotrophic organisms and the gross photosynthesis of the species present. Ammonium from fertilizers broadcast into a high pH water are highly susceptible to direct NH3 volatilization losses. Nitrogen losses from fertilizer broadcast into flood water on a fertile, neutral-pH Maahas clay were as high as 20% of the amount applied, but losses varied depending upon water pH, the nitrogen source, and rate, time, and method of application. Losses from an acid Luisiana clay, where the flood water was not conducive to algal growth and did not exceed pH 6.8, produced NH3 volatilization losses consistently less than 1% of the total N applied. Placement of N fertilizer in the soil at depths of 10-12 cm reduced NH3 volatilization losses to less than 1% of the total N applied. (Skogerboe-Colorado State)
W79-05812

THE FLOW MECHANISM IN THE CHALK BASED ON RADIO-ISOTOPE ANALYSES OF GROUNDWATER IN THE LONDON BASIN,
Department of the Environment, Reading (England). Central Water Planning Unit.
For primary bibliographic entry see Field 2F.
W79-05852

EVALUATION OF THE RATE OF DECREASE IN THE IRON CONTENT OF WATER PUMPED FROM A FLOODED SHAFT MINE IN COUNTY, DURHAM, ENGLAND,
Teesside Polytechnic, Middlesborough (England). Dept. of Civil and Structural Engineering.
R. C. Frost.
Journal of Hydrology, Vol. 40, No. 1/2, p 101-111, January 1979. 2 fig, 1 tab, 22 ref.

Descriptors: *Water chemistry, *Mine water, *Iron, Mine drainage, Coal mines, Theoretical analysis, Regression analysis, Equations, Chemistry, Chemicals, Acid mine water, Oxygen, Pyrite, Iron compounds, Chemical reactions, Flooded mines.

An attempt was made to provide a theoretical basis for the evaluation of field data to decreasing concentrations of iron in the drainage from flooded coal mines. It was thought that this will aid the formulation and adoption of policies aimed at abating the stream pollution caused by these discharges. The removal of pyrite oxidation products from flooded mine workings was described as a convective mass-transfer process, and equations predicting an exponential decrease in their concen-

tration with time were derived from theoretical considerations. In support of this model, the concentration of Fe, C sub c (mg/l), in the water pumped from a flooded shaft mine was found to decrease with time, t (days), according to the regression equation: log C sub c = 1.684 + 0.102 log Q' - 0.000858t where Q' was the instanteous pumping rate (cu m/s). The half-life of 350 days was compared with a value of 334 days calculated from literature data relating to small self-draining drift mines in the U.S.A. The practical value of the model was illustrated by estimation of the volume of ferric hydroxide sludge that might be formed in a treatment facility. (Sims-ISWS)
W79-05933

INFLUENCE OF THE CHEMICAL FORM OF MERCURY ON ITS ADSORPTION AND ABILITY TO LEACH THROUGH SOILS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W79-05944

EXTRACTABILITY OF CADMIUM, COPPER, NICKEL, AND ZINC BY DOUBLE ACID VERSUS DTPA AND PLANT CONTENT AT EXCESSIVE SOIL LEVELS,
Science and Education Administration, Beltsville. Fruit Lab.
For primary bibliographic entry see Field 5B.
W79-05946

2L. Estuaries

WAVE FORCES ON CYLINDERS NEAR PLANE BOUNDARIES,
Naval Facilities Engineering Command, Washington, DC. Chesapeake Div.
J. C. Wright, and T. Yamamoto.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW1, Proceedings Paper 14358, p 1-13, February 1979. 12 fig, 1 tab, 14 ref, 2 append. NOAA 04-5-158-2.

Descriptors: *Waves(Water), *Energy, *Loads(Forces), *Pipes, Underwater, Ocean waves, Pipelines, Oceans, Coasts, Design, Engineering, Coastal engineering, Hydrodynamics, Fluid mechanics, Underwater pipelines, Cylinders.

Wave forces on a horizontal circular cylinder were measured to determine the influence of a plane boundary (e/D), water particle displacement (A/D), and water depth (h/D) on these forces. The transition from potential flow conditions to real flow conditions was considered. The variation of force coefficients of inertia, lift, and drag with respect to e/D, A/D, and h/D was identified. (Sims-ISWS)
W79-05532

PREDICTING SAND DEPOSITION AT POROUS FENCES,
B. P. Petroleum Development Ltd., Aberdeen (Scotland).
For primary bibliographic entry see Field 2J.
W79-05533

LONG WAVE MODEL INDEPENDENT OF STABILITY CRITERIA,
Hawaii Univ., Honolulu. Dept. of Ocean Engineering.
G. Niemeyer.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW1, Proceedings Paper 14345, p 51-65, February 1979. 5 fig, 26 ref, 3 append. NSF DES74-23005.

Descriptors: *Bays, *Water circulation, *Waves(Water), *Model studies, *Hawaii, Mathematical models, Finite element analysis, Inlets(Waterways), Stability, Circulation, Coasts, Currents(Water), Hydrodynamics, Estuaries, *Kaneohe Bay(HI).

Stability conditions for hydrodynamic models can be exceeded if the appropriate terms in the governing equations are approximated with implicit differences. If, in addition, the coefficient matrix for the resulting matrix equations is designed to be time invariant, an efficient simulation technique results. These features were exploited in a finite element-finite difference model of water circulation. The technique, which solves the vertically integrated Navier-Stokes equations, was used to simulate the circulation in a natural embayment where stability requirements for existing techniques would significantly restrict the size of the time step. (Sims-ISWS)
W79-05534

ESTUARINE RESEARCH: AN ANNOTATED BIBLIOGRAPHY OF SELECTED LITERATURE, WITH EMPHASIS ON THE HUDSON RIVER ESTUARY, NEW YORK AND NEW JERSEY,
Geological Survey, Albany, NY. Water Resources Div.
W. N. Embree, and D. A. Wiltshire.
Geological Survey open-file report 78-782, 1978. 58 p.

Descriptors: *Bibliographies, *Abstracts, *Publications, *Estuaries, *Hudson River, New York, New Jersey, Water quality, Tidal effects, Hydrodynamics, Model studies, Information retrieval, Information exchange.

Abstracts of 177 selected publications on water movement in estuaries, particularly the Hudson River estuary, are compiled for reference in Hudson River studies. Subjects represented are the hydraulic, chemical, and physical characteristics of estuarine waters, estuarine modeling techniques, and methods of water-data collection and analysis. Summaries are presented in five categories: Hudson River estuary studies; hydrodynamic-model studies; water-quality-model studies; reports on data-collection equipment and methods; and bibliographies, literature reviews, conference proceedings, and textbooks. An author index is included. Omitted are most works published before 1965, environmental-impact statements, theses and dissertations, policy or planning reports, regional or economic reports, ocean studies, studies based on physical models, and foreign studies. (Woodard-USGS)
W79-05593

DYE-DISPERSION STUDY AT PROPOSED PUMPED-STORAGE PROJECT ON HUDSON RIVER AT CORNWALL-ON-THE-HUDSON, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W79-05596

GRANULAR MEDIA FILTRATION OF DREDGING EFFLUENTS,
Northwestern Univ. Evanston, IL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W79-05621

DISTRIBUTION OF SUSPENDED BACTERIA IN THE NEWPORT RIVER ESTUARY, NORTH CAROLINA,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
A. V. Palumbo, and R. L. Ferguson.
Estuarine and Coastal Marine Science, Vol. 7, No. 6, p 521-529, December 1978. 2 fig, 3 tab, 37 ref. ERDA AT(49-7)-5.

Descriptors: *Bacteria, *Estuaries, *North Carolina, *On-site data investigations, Aquatic bacteria, Marine bacteria, Aquatic microorganisms, On-site data collections, Salinity, Organic matter, Temperature, Water temperature, Chlorophyll, Rainfall, Phosphates, Rivers, Tidal waters, Microscopy, Data processing, Distribution patterns, Aquatic microbiology.

Numbers of suspended bacteria in the Newport River estuary, North Carolina, during June to December 1974, were determined by direct counts using acridine orange and epifluorescent illumination on 0.45 micrometer porosity cellulose acetate filters. Bacteria ranged from 1.95 to 18.4 million cells/ml and were more abundant in the low salinity water (less than 15 parts per thousand) of the upper estuary than in the high salinity water (up to 34 parts per thousand) of the lower estuary. The inverse linear distribution of bacteria with salinity in the lower estuary suggests conservative mixing of bacteria. Prelimnary observations on the distribution of relative dissolved organic matter concentration and on heterotrophic activity indicates the bacteria in the lower estuary are relatively inactive compared to the bacteria in the upper estuary and that the upper estuary may be a source of bacteria to the system. (Sims-ISWS)
W79-05623

A NOTE ON THE INTERNAL SOLITARY WAVES PRODUCED BY TIDAL FLOW OVER A THREE-DIMENSIONAL RIDGE,
University of Southern California, Los Angeles. Dept. of Aerospace Engineering; and University of Southern California, Los Angeles. Dept. of Mechanical Engineering.
T. Maxworthy.
Journal of Geophysical Research, Vol. 84, No. C1, p 338-346, January 20, 1979. 11 fig, 12 ref. ONR N00014-77-C-0015.

Descriptors: *Waves(Water), *Tidal waters, *Tides, *Model studies, Laboratory tests, Tidal effects, Flow, Internal waves, Velocity, Mixing, Density, Estuaries, *Solitary waves, Tidal flow.

Using a simple laboratory model, the mechanisms whereby a train of solitary waves can be generated by the barotropic tidal flow of a stratified fluid over a three-dimensional obstacle were clarified. As the tidal flow reaches critical value of the internal Froude number, a downstream depression is formed in the mixed layer. When the tide slackens and turns, this depression moves upstream and evolves into a sequence of solitary waves. Under some circumstances, the depression becomes turbulent, and intense mixing takes place. In this case it is also the collapse of the mixed region that generates solitary waves which mainly propagate upstream. Available field data are consistent with this explanation, and the number of waves formed using existing theory can be estimated. (Sims-ISWS)
W79-05631

INERTIAL CURRENTS IN LAKE ONTARIO WINTER 1972-73 (IFYGL),
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 2H.
W79-05634

A THREE-DIMENSIONAL MODEL OF LAKE ONTARIO'S SUMMER CIRCULATION, II. A DIAGNOSTIC STUDY,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W79-05635

THE MODELING OF TIDAL FLOW IN A CHANNEL USING A TURBULENCE ENERGY CLOSURE SCHEME,
Reading Univ. (England). Dept. of Meteorology
B. Johns.
Journal of Physical Oceanography, Vol. 8, No. 6, p 1042-1049, November 1978. 5 fig, 3 tab, 10 ref, append.

Descriptors: Tidal waters, *Channel flow, *River *Estuaries, *Model studies, Mathematical model

Tides, Tidal effects, Tidal streams, Flow, Roughness(Hydraulic), Turbulence, Energy, Mathematics, Analytical techniques, *Tidal flow, Turbulence energy.

A parameterization scheme was developed that is suitable for the modeling of turbulence in marine systems, and application was made to the determination of the tidal structure in an elongated channel. The model was used to investigate the practicality of the frequently employed depth-integrated technique, and conclusions were drawn about the customary bottom stress parameterization inherent in that approach. Additionally, it was shown that the value of the roughness length of the elements at the floor of the channel is of importance in determining the frictional dissipation in the model, and an evaluation was made of the tidally induced residual flow in the channel. (Sims-ISWS
W79-05637

SEASONAL CHANGES IN OXYGEN UPTAKE BY SETTLED PARTICULATE MATTER AND SEDIMENTS IN A MARINE BAY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology lab.
B. T. Hargrave.
Journal of the Fisheries Research Board of Canada, Vol. 35, No. 12, p 1621-1628, December 1978. 4 fig, 3 tab, 36 ref.

Descriptors: *Bays, *Canada, *Bottom sediments, *On-site investigations, *Oxidation, Chemical oxygen demand, Biochemical oxygen demand, Sedimentation, Sediments, On-site data collections, Organic matter, Seasonal, Coasts, Water quality, Oxygen demand, Carbon, Respiration, *Nova Scotia, *Bedford Basin(Nova Scotia).

Oxygen consumption by material deposited in sediment traps suspended at different depths in a coastal marine bay was highest during summer. Seasonal changes in respiration (Formalin sensitive oxygen uptake) were significantly correlated with organic content, and highest rates on a dry and organic weight basis occurred during summer. There was no consistent depth-related change in oxygen uptake, but seasonal changes in respiration were significantly correlated over consecutive 10-m depth intervals between 20 and 60 m. Rates of respiration and chemical oxidation by undisturbed sediment cores from 60 m, which were maximum during late summer, were not related to seasonal changes in temperature or dissolved oxygen concentration. A 1-2 month delay existed between the deposition of particulate matter with maximum rates of oxygen consumption and maximum oxygen uptake by bottom sediments. Similar seasonal changes and calculation of the carbon equivalent of sediment respiration, however, showed that oxidation of settled organic matter is largely complete within the year of deposition. (Humphreys-ISWS)
W79-05638

LOSS RATES OF SUSPENDED MATERIAL SEDIMENTED IN A MARINE BAY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
S. Taguchi, and B. T. Hargrave.
Journal of the Fisheries Research Board of Canada, Vol. 35, No. 12, p 1614-1620, December 1978. 2 fig, 2 tab, 25 ref.

Descriptors: *Bays, *Sedimentation, *On-site investigations, *Water quality, *Canada, Coasts, Analytical techniques, Methodology, Estuaries, Carbon, Chlorophyll, On-site data collections, Deposition(Sediments), Suspension, Settling velocity, *Nova Scotia, *Bedford Basin(Nova Scotia), Phaeophytin.

Loss rates for particulate carbon, nitrogen, chlorophyll a, and phaeophytin during the year in a coastal marine bay were calculated by comparison of sedimentation rates and suspended concentration of particulate matter available for deposition. Daily loss of carbon and nitrogen at various depths (1-6% with maximum values during late summer and autumn) generally decreased with depth and was highest when fecal pellet deposition increased during late summer. Loss rates of plant pigments were an order of magnitude lower than those of carbon and nitrogen, except when algal cells settled directly during winter. The observations substantiate previous assumptions that on a daily basis only a small proportion of suspended material is sedimented. Loss rate is dependent on the nature of the suspended particulate matter and physical structure of the water column. (Humphreys-ISWS)
W79-05639

ORIGIN OF DEPOSITED MATERIAL SEDIMENTED IN A MARINE BAY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
B. T. Hargrave, and S. Taguchi.
Journal of the Fisheries Research Board of Canada, Vol. 35, No. 12, p 1604-1613, December 1978. 5 fig, 4 tab, 38 ref.

Descriptors: *Bays, *Sedimentation, *Organic matter, *Canada, *Water quality, On-site investigations, Estuaries, Sampling, Sediments, Water temperature, On-site data collections, Suspension, Carbon, Nitrogen, Chlorophyll, Seasonal, Analysis, Deposition(Sediments), Biomass, Productivity, *Nova Scotia, *Bedford Basin(Nova Scotia), Phaeophytin.

Suspended and sedimented particulate carbon, nitrogen, chlorophyll a, and phaeophytin were measured at various depths throughout the year in a small marine bay. Seasonal and vertical differences in sedimentation rates were not simply related to changes in concentration of suspended particulate matter. Chlorophyll a/total pigment, carbon/nitrogen, and carbon/chlorophyll a ratios in suspended and sedimented material were usually different. Sedimentation rates generally increased with depth with greatest increases during periods of low stratification. Resuspension and horizontal transport of sedimenting material were implied by discontinuities in sedimentation at particular depths. Annual sedimentation of particulate carbon at 20 m depth (below the seasonal thermocline) was equivalent to 15% of the estimated supply from photosynthetic and chemosynthetic production, river discharge, and sewage input. Material deposited during periods of stratification, however, which coincided with high rates of primary production and increased zooplankton biomass during the summer, contained high amounts of carbon and chlorophyll a with a low carbon/nitrogen ratio indicative of a supply from biological production. Although a small fraction of the total suspended particulate matter annually available was deposited, large differences in the quantity and quality of sedimented material occurred seasonally. (Humphreys-ISWS)
W79-05640

NEW YORK BIGHT WATER STRATIFICATION--OCTOBER 1974,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 1A.
W79-05682

MORPHOLOGIC EVOLUTION AND COASTAL SAND TRANSPORT, NEW YORK--NEW JERSEY SHELF,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 2J.
W79-05684

DEVELOPMENTAL TESTS ON THE USE OF FLUORESCENT TRACERS AND BACKWASH SEDIMENT-LOAD SAMPLERS TO MEASURE THE BEACH DRIFT COMPONENT OF LITTORAL TRANSPORT AT SANDY HOOK, NEW JERSEY,
Teachers Coll., New York. Dept. of Science Education.
For primary bibliographic entry see Field 2J.
W79-05688

BACTERIAL FLUX IN SOME NEW JERSEY ESTUARINE SEDIMENTS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Microbiology; and Rutgers - The State Univ., New Brunswick, NJ. Marine Sciences Center.
C. D. Litchfield, J. P. Nakas, and R. H. Vreeland.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Vol. 2, p 340-353, 1976. 6 fig, 4 tab, 30 ref. NSF-GA-32440.

Descriptors: *Baseline studies, *Bacteria, *Sediments, Bottom sediments, Estuaries, Water pollution effects, *Outer Continental Shelf, *New York Bight, Estuarine processes.

From July 1972 through December 1974 ten sampling trips were made in Raritan Bay and Sandy Hook Bay to obtain estuarine sediments. The cores were subsectioned at approximately 10-cm intervals and each section was analyzed for pH, Eh, carbon, nitrogen, percent moisture, total aerobic colony forming units, and facultatively anaerobic colony forming units. Replica plate technique was used to determine the inorganic and organic nitrogen requirements of the cultured aerobic colonies. Sedimentary bacterial populations exhibit wide fluctuations in total numbers (up to five orders of magnitude), relative population components, and inorganic nitrogen requirements. These fluxes cannot be correlated overall with season, sediment particle size, nitrogen or carbon content, pH, or Eh. Although the general trend of high bacterial numbers in silt-clay sediments exists, the marked decrease in total and specific bacterial flora at station 15 makes it impossible to consider this an absolute principle for estimating bacterial numbers and potential for activity in marine sediments. (Sinha-OEIS)
W79-05704

SALINITY DEPENDENT DISTRIBUTION OF BENTHIC ALGAE IN ESTUARINE AREAS OF ICELANDIC FJORDS,
Slovenska Akademija Znanosti in Umetnosti, Ljubljana (Yugoslavia). Biological Inst.
For primary bibliographic entry see Field 5C.
W79-05745

QUALITY OF SELECTED WATERS IN SOUTHERN MAINE.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality Control.
For primary bibliographic entry see Field 5B.
W79-05832

LONGSHORE TRANSPORT AT A TOTAL LITTORAL BARRIER,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2H.
W79-05838

DETECTION OF HEAVY METAL POLLUTION IN ESTUARINE SEDIMENTS,
Florida State Univ., Tallahassee. Dept. of Oceanography; and Florida State Univ., Tallahassee. Florida Resources and Environmental Analysis Center.
For primary bibliographic entry see Field 5B.
W79-05850

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PARAMETRIC STUDY ON BRACKISH WATER MEMBRANE DESALTING PLANTS,
Burns and Roe Industrial Services Corp., Paramus, NJ.

Group 3A—Saline Water Conversion

S. V. Cabibbo, D. B. Guy, A. Ko, A. Ammerlaan, and R. Singh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 080, Price codes: E20 in paper copy, E07 in microfiche. Report, 1979, 3 Vol, 1885 p, 4 append. OWRT (No. 7544)(1), 14-34-001-7544(1).

Descriptors: *Pretreatment requirements, *Base case desalting costs, *Major cost center analysis, *Proposed development program, Reduced pressure cases, Independent parameter costs, Large plant case cost analysis, Process diagrams, Power recovery system, Inter-stage pressure boosting, *Desalination, *Membrane processes, *Reverse osmosis, *Electrodialysis, Brackish water.

A detailed engineering and economic study was undertaken on spiral wound and hollow fiber reverse osmosis module designs and a tortuous path electrodialysis stack design used in membrane desalting plants with product water capacities of 1, 5 and 10 million gallons per day. The minimum pretreatment required, based on each of the six brackish waters, was determined to achieve water recoveries of 70, 80 and 90 percent. The preferred pretreatment was acidification. Plant layout arrangements, process flow and piping and instrumentation diagrams were prepared in detail for use as a basis for preparing capital and annual cost estimates. The impact of reduced pressure operation, interest rate, electric power cost and membrane life on product water costs was determined. The cost data indicated that membranes and modules averaged 26.5% of total capital costs and 19.4% of annual costs. Operating and maintenance labor required 23.4% of annual costs while electricity and chemicals were 13.8% and 11.9% respectively. A research and development program was outlined to reduce costs and improve reliability.
W79-05501

BIBLIOGRAPHY OF PUBLICATIONS ON COMPOUNDS OF GAS HYDRATE TYPE,
Pittsburgh, Univ., PA.
For primary bibliographic entry see Field 10C.
W79-05572

RESEARCH INVESTIGATIONS OF MULTIPLE-EFFECT EVAPORATION OF SALINE WATERS BY STEAM FROM SOLAR RADIATION,
Battelle Memorial Inst., Columbus, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 377, Price codes: A02 in paper copy, A01 in microfiche. OSW Summary of Research and Development Progress Report No. 2, December 1953. 6 p, 2 tab.

Descriptors: *Desalination, *Desalination processes, *Solar stills, *Multiple-effect evaporation, Desalination apparatus, Cost estimates, Operating costs, Unit costs, Water costs, Feasibility studies, Sea water, Saline water, Solar radiation, Evaporation, Water treatment, Water purification, Water quality, Equipment.

A project entailing a preliminary study in two parts of the feasibility of producing distilled water from sea water using multiple-effect evaporation and steam generated in solar collectors is summarized. In Part one the amount of solar energy available for collection with various types of collectors and concentrators was determined, and cost estimates of $4 to $5/sq ft were obtained from preliminary designs. Operating data and investment and operating costs for multiple-effect evaporators varying in size and number of stages were obtained in Part two. Costs of the piping joining the collector elements and the still were also estimated. When these costs were combined with the solar energy collector costs it was determined that plant size should be such that 40,000 gallons/hr of distilled water be produced to minimize labor costs; a six to eight effect flash type still would give the lowest overall cost. It is concluded that fresh water could be produced with the equipment and technology available (1953) at a cost of $3.25/1000 gallons. (Davison-IPA)
W79-05573

RESEARCH ON VAPOR REHEAT AND LIQUID-LIQUID HEAT EXCHANGE,
FMC Corp., Santa Clara, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 538, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 78, September 1963. 104 p, 26 fig, 10 tab, 3 append. 14-01-0001-234.

Descriptors: *Desalination, *Desalination apparatus, *Desalination processes, *Liquid-liquid heat exchange, *Vapor reheat, Distillation, Heat exchangers, Mass transfer, Salinity, Water treatment, Water quality, Water quality control, Equipment.

A two column liquid-liquid heat exchanger system and a five stage, direct contact, vapor reheat distillation system have been designed, constructed, initially tested, operated as separate units, and operated as a completely integrated desalination system. The data obtained from both components is sufficient for a preliminary pilot plant design. The data, statistically correlated, predict performance and optimum dimensional requirements for the heat exchangers, and are presented graphically. Mass transfer and product salinity data for the distillation column are presented in graphic and tabulated form. In the heat exchanger system, minor design changes are expected to result in improved performance in the fresh water cooler. Further experimental work is necessary on the sea water heater, because its performance was below expectations. Mass transfer coefficients for the distillation system were in the range predicted from previous experiments. For production rates up to 1000 lbs/hr the product salinity was below 500 ppm. The process and test equipment are described; operating problems are discussed. (Davison-IPA)
W79-05574

DESALINATION BY ELECTROSORPTION AND DESORPTION,
Southern Research Inst., Birmingham, AL.
R. E. Lacey, and E. W. Lang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 683, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 106, July 1964. 41 p, 8 fig, 6 tab, 3 ref. 14-01-0001-335.

Descriptors: *Desalination, Desalination processes, *Demineralization, *Electrosorption, Electrochemistry, Physicochemical properties, Membranes, Membrane processes, Coatings, Films, Saline water, Salinity, Sodium chloride, Cost analysis, Estimated costs, Capital costs, Amortization, Water treatment, Water quality, Water quality control.

The membrane process for demineralizing saline water, electrosorption, was studied on a laboratory scale to determine whether demineralization occurs by electrosorption, to study the theoretical basis for the process, and to estimate its economic feasibility. Three types of composite membranes were used in demineralization experiments, and coated membranes were developed for experimental evaluation of the process. It was shown that saline water can be demineralized efficiently by electrosorption at a cost possibly lower than that for electrodialysis. Product water containing 400 ppm of sodium chloride can be produced from feed water containing 3500 ppm. The time necessary for the regeneration portion of the cycle requires 35 to 40% of the total cycle, less than the time required for demineralization. Very little product water was lost due to hold up of solution within the demineralizer at times of voltage reversal. Electrosorption membranes possessing good electrochemical properties were produced by coating base films with condensation-type ion-exchange resins and curing the coatings. Preliminary estimates of the cost of demineralization by electrosorption were made and compared to costs of electrodialysis. The major saving anticipated for the electrosorption process over electrodialysis is in amortized capital costs. (Davison-IPA)
W79-05575

THE MINIMUM REQUIREMENTS FOR SEA WATER CONVERSION PROCESSES,
State Univ. of New York at Albany.
G. W. Murphy, R. C. Taber, and H. H. Steinhauser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-251 888, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 9, April 1956. 78 p, 7 fig, 4 tab, 4 ref, 5 append.

Descriptors: *Desalination, *Desalination processes, *Energy, *Energy conversion, *Energy loss, Energy transfer, Thermodynamics, Heat transfer, Vapor compression distillation, Water treatment, Water quality, Water quality control, Sea water.

The ultimate of idealizations of desalination processes were studied thermodynamically to: (1) classify the methods on the basis of thermodynamic criteria; (2) show that regardless of the method, the minimum thermodynamic work is the same; and (3) approximate the energy requirements as a basis for studying real processes. Rate phenomena, part of every process, are analyzed and lead to the approximation of energy requirements for specific methods. Calculations were performed for compression distillation and the electrical separation process. In each of these the practical minimum energy requirement is estimated at four times the thermodynamic minimum, except for the losses in energy conversion devices and water transport requirements. This is regarded as a crude approximation when compared to the exact theoretical approximations. Since it is difficult to judge how much a further reduction in idealization would raise the energy value, further work is recommended. (Davison-IPA)
W79-05576

SALINE WATER CONVERSION DEMONSTRATION PLANT, WEBSTER, SOUTH DAKOTA: FIRST ANNUAL REPORT,
Mason-Rust, Webster, SD.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 680, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 101, March 1964. 131 p, 18 fig, 17 tab, 4 ref. 14-01-001-225.

Descriptors: *Desalination plants, *Evaluation, *Brackish Water Conversion Demonstration Plant No. 3, *Electrodialysis, Scaling, Equipment, Capital costs, Operating costs, Desalination processes, Desalination apparatus, Water treatment, Water quality, Water quality control, Pretreatment(Water), Brackish water, Webster(SD).

Part I presents maintenance, operational history, and technical, economic and administrative evaluations of the 250,000 gpd Brackish Water Conversion Demonstration Plant No. 3 in Webster, South Dakota, for the period March 9, 1962 through June 30, 1963. The usage of Calgon, aeration of the feedwater, membrane polarization and scaling, and the incorporation of polarity reversal into the Asahi process were among the process problems encountered. Among the equipment failures were moisture absorption and distortion of dilution compartment gaskets, sludge carryover from the iron/manganese removal filter units, and pump failures including city-owned water delivery and waste disposal pumping equipment. The cost figures given were affected by the process difficulties and the resulting interruptions in plant production. In Part II, the principles of electrodialysis are discussed; plant construction and the following plant components are described: pretreatment equipment, electrodialysis equipment, electrical system, instrumentation, and miscellaneous equipment. The plant operation and problems encountered during initial operation of the plant are summarized. Capital costs for Demonstration Plant No. 3 are compared with normalized capital costs for a 250,000 gpd plant. (Davison-IPA)

W79-05577

REMOVAL OF SCALE-FORMING COMPOUNDS FROM SEA WATER,
Grace (W.R.) and Co., Clarksville, MD. Research Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 118, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 57, February 1962. 94 p, 16 fig, 26 tab, 5 ref, 4 append. 14-01-001-202.

Descriptors: *Desalination, *Pre-treatment(Water), *Descaling, *Fertilizers, Ammonium compounds, Phosphates, Scaling, Economic feasibility, Sea water, Trace elements, Water analysis, Water chemistry, Water treatment, Water quality, Water quality control, Desalination plants.

The formation of scale deposits of calcium and magnesium salts cause malfunction and loss of efficiency in the operation of distillation equipment. Calcium and magnesium were removed from sea water by precipitation of the insoluble phosphates, magnesium ammonium phosphate and dicalcium phosphate, which have value as fertilizer. Therefore, an investigation was undertaken to determine the economic feasibility of preparing a high analysis fertilizer from the elements removed during the pretreatment of raw sea water. The fertilizer produced from the scale forming elements was a mixture of magnesium ammonium phosphate, calcium hydrogen phosphate, and the trace metal phosphates, iron, zinc, copper, manganese, cobalt, and nickel; it was non-burning and non-leaching. The precipitation process developed, low cost sodium phosphate was produced from fertilizer grade phosphoric acid and mixed with sea water. The addition of ammonia caused the precipitation of solids which were allowed to settle from the water. The descaled sea water was ready to be used in a water conversion plant. A slurry of the precipitated solids, i.e., fertilizer, was dehydrated by heating, then filtered, washed and dried. Assuming a descaling plant of one mgpd capacity, the fertilizer produced would have to command a price twice that of conventional farm fertilizers and be marketed as a specialty fertilizer. (Davison-IPA)
W79-05578

INVESTIGATION AND DEVELOPMENT OF AN ELECTROLYTIC SYSTEM FOR THE CONVERSION OF SALINE AND BRACKISH WATERS,
ESB, Inc., Yardley, PA.
C. F. Norberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 929, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 51, August 1961. 56 p, 28 fig, 5 tab. 14-01-001-190.

Descriptors: *Desalination, *Membrane processes, *Ion exchange, *Desalination apparatus, Conductivity, Water treatment, Water quality, Water quality control, Resins, Plastics, Saline water, Brackish water, Energy.

Work on electronically conducting ion exchange materials and an investigation of electrolytic regeneration with a type of mixed bed apparatus are summarized. Graphite-ion exchange resin polyethylene and graphite cloth impregnated with ion exchange materials were tested to determine whether their electrolytic regeneration was less economical than electrolytic regeneration of a conventional resin. Chemical regeneration of the conventional resin was the most effective and economical. It was found that generally electrolytic regeneration of ion exchange materials modified to impart electronic conductivity was less economical than electrolytic regeneration of conventional resins. A membrane-type mixed bed that could be operated with continuous electrolytic regeneration was constructed. The desired degree of desalting was achieved by regulating the flow rate and current. The energy required/volume of water treated was much higher than for desalination with multiple membrane electrodialysis units. (Davison-IPA)
W79-05579

DEMINERALIZATION OF SALINE WATER THROUGH PRESSURIZATION CYCLES WITH ION EXCHANGE MATERIALS,
Western Independent Research Lab., Inc., Los Angeles, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 485, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 75, July 1963. 33p, 4 fig, 10 tab, 32 ref. 14-01-001-238.

Descriptors: *Desalination processes, *Pressure, *Pressurization cycles, Saline water, Sea water, Demineralization, Energy conversion, Energy, Desalination, Water treatment, Ion exchange, Water purification, Water quality, Water quality control.

Mechanical pressure applied to ion exchange materials equilibrated with saline solution produced an effluent with greatly reduced salt concentration. With a final pressure of 6255 psi a concentration of 0.7 molar sodium chloride was reduced to 0.01 molar in four cycles. Demineralization of sea water was accomplished in two cycles by utilizing a fractional procedure whereby the second half of the effluent from that cycle was a satisfactory product. The energy requirements for this process were no greater than those for present distillation processes. The partial success of hydraulic pressurization of ion exchange materials in first generation equipment was significant, because of the cost reduction possible in the construction of hydraulic rather than mechanical pressurization equipment. (Davison-IPA)
W79-05580

HEAT TRANSFER IN THE LTV EVAPORATOR: AN ANALYSIS OF PILOT PLANT DATA AND PREDICTIVE TECHNIQUES FOR PLANT OPERATION AND DESIGN,
Prengle, Dukler and Crump, Inc., Houston, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 484, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 74, June 1963. 99 p, 16 fig, 11 tab, 32 ref.

Descriptors: *Desalination, *Desalination processes, *Long tube vertical evaporator, *Heat transfer, Pilot plants, Temperature, Operations, Design criteria, Tubes, Resistance, Water treatment, Water purification, Wrightsville Beach(North Carolina).

Heat transfer data obtained on a seven tube Evaporator unit in a pilot plant facility at Wrightsville Beach, North Carolina, were compared with theoretical heat transfer coefficients. The good agreement shown was also shown to depend on the validity of an assumed relationship for pressure drop in the tube under vacuum. On the basis of the study it was concluded that: (1) two phase pressure drop in the tube is significant causing substantial changes in temperature and in T driving force; (2) overall coefficient cannot be calculated from terminal conditions; (3) overall coefficients do not drop markedly in the low pressure effect; (4) steam side resistances were larger than those on the saline side under many operating conditions in the pilot plant; and (5) entrainment in the two inch tube, as high as 30% at high vacuum conditions, may be expected to cause dry spotting and/or excess local concentrations which could cause scaling. The study indicates that optimum plant design cannot be achieved by using the same tube diameters and lengths for all effects. When pressure drop and entrainment rates can be accurately determined it will be possible to select a distribution of tube size and lengths which will produce optimum performance in a multi-stage system. (Davison-IPA)
W79-05581

DEVELOPMENT OF THE DIRECT FREEZE SEPARATION PROCESS,
W. J. Hahn, R. C. Burns, R. S. Fullerton, and D. J. Sandell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 703, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 113, June 1964. 122 p, 27 fig, 2 tab, 3 append. 14-01-0001-286.

Descriptors: *Desalination, *Desalination processes, *Direct freeze separation process, *Vapor adsorption, Pilot plants, Water treatment, Water quality, Standards, Evaluation, Separation techniques, Freezing, Costs, Cost analysis, Economic feasibility, Sea water, Brines, Water costs, Wrightsville Beach(North Carolina).

Further evaluation of the 15,000 ggd pilot plant at Wrightsville Beach, North Carolina, was carried out to determine the technical and economic feasibility of the direct freeze-separation process of the primary refrigerant type for the desalination of sea water. The primary refrigerant type of direct freezing may be further classified into the vapor compression or the vapor adsorption type. The vapor absorption type of process was selected as the most economical way to demonstrate the basic functions of freezing and separating ice from brine. The design, operation and performance of the pilot plant are described. An evaluation of the potential economics of this process is based on a plant with a 165,000 gpd capacity. Sustained production of potable water was demonstrated using less than 5% of the total product for separation. The chemical quality of the product water met the Public Health Service Drinking Water Standards except for a higher iron content which could be reduced by filtering the final product. The bacteriological quality of the product water, which met the standards, is dependent on the pollution content of the feed water. In achieving an operating cost of $1.00/1000 gallons, the major elements of the total operating costs must be reduced to very low levels. Fixed costs amount to $.38/1000 gallons for each $1.00 of plant investment/gpd of capacity. (Davison-IPA)
W79-05644

POTENTIAL USE OF CONVERTED SEA WATER FOR IRRIGATION IN PARTS OF CALIFORNIA AND TEXAS,
Bureau of Reclamation, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 378, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 5, April 1954. 19 p, 2 fig, 1 tab.

Descriptors: *Water supply, *Potential water supply, *Desalination, *Irrigable land, *Arable land, Water supply development, Water requirements, Agriculture, Irrigation, Irrigation programs, Irrigation systems, Irrigation water, Water utilization, California, Texas.

An inventory of arable lands within reasonable distance from or height above the source of sea water and of more remote lands that might be served by exchange of water rights lands near the coast is presented. The areas in Texas and California which were inventoried have limited amounts of undeveloped local water supplies and limited possibilities for increasing those supplies through importing natural water. It is assumed that estimated demands for water for municipal and industrial use will be met before demands for irrigation water. Estimates of future municipal and industrial requirements were used to estimate future deficiencies of local supply. Estimates of irrigable acreages and the amounts of water they would require are presented. Much of this land had not been given prior consideration as arable because of the lack of an assured water supply. The individual California and Texas areas are discussed in terms of elevation, distance from the sea, and the local water supply. It is concluded that the ultimate water requirements of those areas surveyed exceed local supplies; that it is physically possible to meet all the future water requirements of the areas within reasonable distance and height above sea level with converted sea water; and those areas beyond the

assumed economic reach of the converted sea water could benefit by exchange of water. (Davison-IPA)
W79-05645

RESEARCH ON FORCED-CIRCULATION AND DROPWISE CONDENSATION TECHNIQUES FOR IMPROVING HEAT TRANSFER RATES FOR VAPOR COMPRESSION EVAPORATORS,
Yale Univ., New Haven, CT. Dept. of Engineering and Applied Science.
H. Bliss.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 383, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 8, October 1977. 28 p, 12 fig, 4 tab. 14-01-001-59.

Descriptors: *Desalination, *Desalination processes, *Evaporation, *Vapor compression distillation, *Dropwise condensation, Heat transfer, Sea water, Steam, Temperature, Tubes, Correlation analysis, Mathematical studies, Water treatment, Water purification, Separation techniques, Water quality.

An experimental program is reported in which measurements of overall and film heat transfer coefficients with pure water or pure NaCl brine were taken, and tests of scaling behavior were made over an extended period with synthetic sea water and Long Island Sound sea water. A forced circulation evaporator was constructed in which water and brine were heated in the tubes and evaporation was accomplished by flashing after leaving the tubes. The 204 runs included the following variables: flow rate of liquid, steam temperature, steam pressure, brine concentration, inside tube diameter, and the nature of condensation (film, dropwise and mixed). The high heat transfer coefficients obtained in forced circulation evaporation with dropwise condensation were many times as large as those obtained with the usual equipment in this field. Results indicated that dropwise condensation can be maintained without taste or odor in the water. Brine coefficients determined from these data were in agreement with the generalizations of Dittus and Boetler. However, the film condensation coefficients were about 30% higher than the theory of Nusselt. Scaling studies were done by operating the unit continuously for 760 hours. the scaling which occurred indicated an approximate 33% drop in the heat transfer coefficient in a 30-day month. (Davison-IPA)
W79-05646

THEORETICAL STUDIES OF THE BEHAVIOR OF IONS IN AQUEOUS SOLUTIONS OF MIXED ELECTROLYTES WITH RESPECT TO OSMIONIC OPERATION,
Oklahoma Univ., Norman.
G. W. Murphy, and R. R. Matthews.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 486, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 76, July 1963. 63 p, 9 fig, 68 ref, 1 tab, 1 append. 14-01-001-191.

Descriptors: *Desalination, *Membranes, *Theoretical analysis, *Osmionic process, *Permselective membranes, Demineralization, Electrolytes, Anions, Cations, Thermodynamics, Equilibrium, Aqueous solutions, Electrochemistry, Equations.

Osmionic cell operation and ion behavior were studied through examination of various theories. The discussion of non-equilibrium processes in electrolytes and membrane systems includes phenomenological equations, entrophy production and the flux of ions in an electrical field. Ion-selective membranes and the osmionic process, a system of cation- and anion-selective membranes, are described. Ion fluxes in solutions of electrolytes are discussed with regard to the density of electric current, and electrochemical potentials. A program for computer solution of the set of simultaneous first order differential equations is developed. (Davison-IPA)
W79-05647

PART I: SURVEY OF PHYSIOLOGICAL MECHANISMS OF SODIUM AND CHLORIDE ION TRANSPORT AND DESIGN OF EXPERIMENT FOR APPLICATION TO DEMINERALIZING SALINE WATERS - PART II: LABORATORY EVALUATION OF USE OF ALGAE IN SALINE WATER CONVERSION -- PHASE I FINAL REPORT,
Resources Research Inc., McLean, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 930, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 52, September 1961. 123 p, 2 fig, 5 tab, 176 ref. 14-01-001-96 and 14-01-001-109.

Descriptors: *Desalination, *Ion transport, *Algae, *Marine algae, *Salt balance, Biological membranes, Absorption, Physiology(Animal), Physiology(Plant), Biochemistry, Saline water, Water purification, Water treatment, Water quality, Information retrieval.

In Part I, the medical biochemical and physiological literature was searched for information concerning the natural processes by which salt concentration gradients are established and maintained between organisms and their environment. Information relating to the function of the human kidney was examined in addition to information on the salt conserving actions of the sweat and secretory glands, and kidney and other animal salt-concentrating functions. The accumulation and excretion of salts in plants, single-celled organisms and tissue cells were studied. A method of utilizing algae for the conversion of saline water was proposed in which the algae would be recycled to reduce the quantity of algae that must be handled and to eliminate the generation time required to produce fresh algae. The emphasis in Part II was on a screening process to seek algae with favorable characteristics for use in saline water conversion. Over 100 species of fresh water and marine algal cultures were screened and uptake studies were conducted in the laboratory. Approximately 25% of the sodium determinations and 20% of the chloride determinations indicated that the concentrations of these ions in the test media increased 2 to 3% during the time the algae grew. It is believed that this was due to errors in compensating for the volume changes occurring in the cultures during the tests. Many species exhibited good growth, were of the proper size range, and showed good ability to concentrate sodium chloride. It is noted that the data obtained does not lend itself to detailed statistical analysis. Further study is recommended. (Davison-IPA)
W79-05648

DEMINERALIZATION OF SALINE WATER BY ELECTRICALLY-INDUCED ADSORPTION ON POROUS CARBON ELECTRODES,
Oklahoma Univ., Norman.
G. W. Murphy, J. J. Bloomfield, F. W. Smith, W. E. Neptune, and J. O. Purdue.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 589, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 92, Annual Report VI, March 1964. 81 p, 14 fig, 18 tab, 17 ref, 3 append. 14-01-001-160.

Descriptors: *Desalination, *Desalination processes, *Demineralization, *Electrodes, *Adsorption, *Carbon, Porosity, Polyelectrolytes, Cations, Anions, Water treatment, Water purifications, Separation techniques, Saline water.

Continuing research on porous carbon electrodes is reported in the following areas: (1) the bench scale demineralization unit; (2) polyelectrolyte dispersants for anion-responsive electrodes; (3) the use of polymeric binders in the preparation of cation-responsive electrodes; (4) the development of a new and faster means of characterizing electrodes; (5) testing demineralization electrodes against ions other than sodium and chloride; (6) long-term demineralization tests of electrodes; and (7) the extension of the cell theory of electrolyte solutions to unsymmetrical electrolytes and to more concentrated solutions. Difficulties with the EPR rubber end-plate facings encountered during the 40-day shakedown run of the bench scale unit were alleviated by using sealed graphite end plates and bipolar electrodes. Studies carried out to improve anion electrode capacity included comparison of the anion-responsive effects imparted by different salts of quarternized polyvinylimidazole and polyethylenimine. Alkali washing of carbons prior to dispersion with cationic polyelectrolytes which increased the capacity of all anion-responsive electrodes studied may be adopted as standard procedure. Cation-responsive electrodes with improved stability were made with polymeric binders rather than aqueous dispersing agents. Anion-responsive electrodes made by dispersion with polyvinylimidazole hydroxide exhibit greatly improved stability over electrodes made with other salts of quarternized PVI. (Davison-IPA)
W79-05649

DEVELOPMENT OF THE SOLVENT DEMINERALIZATION OF SALINE WATER,
Texas A and M Coll., College Station. Dept. of Oceanography.
R. Davison, A. F. Isbell, W. H. Smith, Jr., and D. W. Hood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 036, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 55, September 1961. 148 p, 30 fig, 10 tab, 13 ref. 14-01-001-174.

Descriptors: *Desalination, *Desalination processes, *Demineralization, *Solvent extraction, *Liquid-liquid extraction, Solvents, Ethers, Organic compounds, Analytical techniques, Spectrophotometry, Gas chromatography, Thermodynamics, Physicochemical properties, Water purification, Water treatment, Water quality, Saline water.

The development of the liquid-liquid extraction process for desalination was continued through examination of a large group of commercially obtainable solvents. In addition, a number of amines, ethers, alkyphosphonamides, and pyrroles were constructed and examined in a similar manner. By mixing two amines with near ideal properties solubility curves of almost ideal characteristics were obtained. Triethylamine - methydiethylamine gave solubility curves which permit the process extraction temperature to range between 18 and 55. Mixed amines have solvent properties nearly ideal for brackish water conversion. Results calculated from model scale investigations of various solvents were almost identical to those obtained from calculations of heterogeneous equilibrium data. A technical and economic evaluation of the Texas A and M Solvent Extraction Process pertaining to saline water conversion indicated that the technical phases of the overall process were valid and the cost of producing 1,000 gallons of water in a 10 million gpd plant would be about $1.12. Although the spectrophotometric method developed was satisfactory for analysis, it was not applicable to continuous observation of amine content of water on a process stream. An analysis of amine solvents to determine the effects of structure on thermodynamic factors enabled the prediction of solubility curves from knowledge of vapor pressure in the single liquid phase region of the solubility curve. (Davison-IPA)
W79-05650

DESIGN, CONSTRUCTION, FIELD TESTING AND COST ANALYSIS OF AN EXPERIMENTAL ELECTRODIALYSIS DEMINERALIZER FOR BRACKISH WATERS,
Ionics, Inc., Watertown, MA.
J. P. Dankese, T. A. Kirkham, G. Maheras, M. S. Mintz, and J. H. Powell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 386, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 11, December 1956. 144 p, 26 fig, 31 tab. 14-01-001-66.

Descriptors: *Desalination, Desalination processes, *Electrodialysis, On-site investigations, Separation techniques, Membranes, Scaling, Acidity, Alkalinity, Costs, Estimated costs, Water treatment, Water quality, Water purification, Brackish water.

A 1,000 gph experimental apparatus capable of reducing the salinity of brackish water with 4,000 ppm dissolved solids to 350 ppm was built and tested. The first tests, of six months duration, were in Arizona where the unit operated on an irrigation water supply with 4,000 ppm dissolved salts. Fouling or plugging of the membranes and flow channels occurred, and membrane strength deteriorated. Calcium carbonate scaling was found to be the major cause of plugging; the condition was controlled by adjustments in the acidity or alkalinity of the water. The second set of tests, of three months duration, was on a municipal water supply from a deep well with 2,000 ppm dissolved salts in Miller, South Dakota. The operating procedures developed in Arizona and the use of new type membranes reduced the fouling difficulties, but did not eliminate them completely. It was found that the amount of treated water obtained from a quantity of brackish water was limited by the difficulty soluble salts present, such as calcium sulphate. These field tests demonstrated that the electrodialysis process could be used to reduce the salinity of the waters to below 350 ppm. Cost estimates were made for the 25,000 gpd field unit and extrapolated for larger plants with 1,500,000 gpd and 75,000,000 gpd capacities. Cost estimates based on field results were six times higher than estimates based on laboratory results. Chemical analysis of the water to be treated must be taken into consideration in future planning and evaluating the process for various applications. (Davison-IPA)
W79-05651

ANNUAL REPORT (FY 1969) FREEPORT TEST FACILITY AND VERTICAL-TUBE-EVAPORATOR TEST BED PLANT, FREEPORT, TEXAS,
Stearns-Roger, Inc., Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 581, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 559, 1969. 112 p, 7 fig, 23 tab, 5 ref, 1 append. 14-01-0001-1804.

Descriptors: *Desalination plants, Desalination processes, *Long-tube vertical distillation, *Desalination, Water purification, Mechanical equipment, Hydraulic machinery, Economics, Capital costs, Operating costs, Cost analysis, Cost comparisons, Evaluation, On-site investigations, Corrosion, Construction materials, Evaporation, Demonstration Plant No. 1, Freeport(Texas).

A wide variety of information, findings, and recommendations concerning the Long-Tube Vertical (LTV) multiple-effect evaporation method of desalination employed by Demonstration Plant No. 1, Freeport, Texas, is presented. The technical, logistical and economic evaluations for fiscal year 1969 operations are discussed in addition to the process and mechanical development program results as related to the LTV process in particular and desalination in general. Capital and operating costs are compared to theoretical normalized capital and operating costs. Production and maintenance costs averages are presented, and relevant operating and maintenance experience are discussed. A technical evaluation of the existing process includes the 5-effect module, the mechanical equipment, and construction materials. The detailed process evaluation includes presently defined limitations of the temperatures and concentration ratios for scale-free operation LTV evaporators without presoftening the feedwater. The operations of the single effect test evaporator, the auxiliary test unit, are analyzed and discussed. Test results of newly installed equipment of advanced design are presented. (Davison-IPA)
W79-05652

FREEZING PROCESS STUDIES,
Syracuse Univ., NY. Dept. of Chemical Engineering and Materials Science.
D. J. Fontugne, H. Mason, J. E. Bajolle, R. A. Rice, and A. J. Barduhn.
OSW Research and Development Progress Report No. 501, December 1969. 93 p, 19 fig, 14 tab, 51 ref, 4 append. 14-01-0001-1135.

Descriptors: *Freezing, *Desalination processes, *Porous media, *Porosity, *Permeability, *Anisotropy, Crystallography, Crystals, Isotropy, Physical properties, Activated carbon, Separation techniques.

In a study of anisotropy in porous media, a two dimensional permeability cell was developed which can be used to measure beds with a wide range of permeabilities. Additional two dimensional permeability data was obtained on beds of mica flakes and activated carbon particles in which the horizontal permeabilities are approximately twice as high as the vertical permeabilities. The experiments performed with the cell show that spherical particles matched the numerical study of the flow equation in the isotropic case. It is concluded that the calibration curve is correct, because the solution of the flow equation in the anisotropic cases is calculated in a manner similar to the isotropic case. The apparatus is only limited in use for use with large particles because of the wall effect, and for small particles by the size of the screen openings. Conclusions concerning porous media include: (1) spherical glass particles form only isotropic beds and all asymetric particles settle into anisotropic beds; (2) the degree of anisotropy is independent of the porosity or degree of compaction; (3) for the same material the degree of anisotropy increases when the particle size decreases because of the more irregular shape of the smaller particles; and (4) flat mica particles formed a medium with the permeability along the bedding plane being twice the amount as the permeability across the bedding plane. (Davison-IPA)
W79-05653

RESEARCH ON LIQUID-LIQUID EXTRACTION FOR SALINE WATER CONVERSION,
Texas A and M Coll., College Station. Dept. of Oceanography.
R. Davison, L. M. Jeffrey, U. G. Whitehouse, and D. W. Hood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 396, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 22, December 1958. 8 p, 15 fig, 11 tab, 4 ref. 14-01-001-77 and 14-01-001-60.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Liquid-liquid extraction, Solvents, Adsorption, Solvent extractions, Separation techniques, Equilibrium, Saline water, Sea water, Water treatment, Water purification, Heat transfer.

A series of screening tests was conducted on a variety of liquid organic solvents in a search for the most efficient solvent or solvents to be used in the desalination of sea water. The correlation of solvent properties with molecular structure and solvent purity were given special attention. Detailed data was obtaned on phase equilibrium of the most promising compounds. Of the methods investigated for the recovery of solvents from the brine and product water, liquid-liquid extraction and adsorption on activated carbon and clay were studied. Although the laboratory model was too small for the collection of data which could be used in designing a larger unit, it enabled comparisons of solvents as to flooding rates, extraction rates, ease of phase separation, and served as a check on performance calculated from phase equilibrium data. Preliminary engineering cost estimates were made based on a liquid-liquid extraction plant processing 20 million gpd of sea water with 35,000 ppm total solids to produce 10 million gpd of product water with 500 ppm solids and 10 million gpd of waste water containing 70,000 ppm solids. The total estimated cost of product water was $1.98/1000 gallons. Tertiary-octylamine was considered the best solvent for use at this time. The introduction of a liquid heat transfer medium in place of the concentric piping system could reduce the costs associated with the heating cycle. Further cost reductions could be achieved through utilizing larger, more efficient extractor systems. (Davison-IPA)
W79-05654

DEMINERALIZATION OF SALINE WATERS: A PRELIMINARY DISCUSSION OF A RESEARCH PROGRAM,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 373, Price codes: A07 in paper copy, A01 in microfiche. Report October 1952. 69 p, 2 tab.

Descriptors: *Desalination, *Desalination processes, *Bibliographies, *Patents, Energy, Vapor compression distillation, Evaporation, Flash evaporation, Crystallization, Solar distillation, Adsorption, Sublimation, Osmosis, Ion exchange, Ultrasonics, Hydration, Precipitation, Electrolysis, Permselective membranes, Fuels, Nuclear energy, Demineralization.

A summary of available information (1952) on demineralization of saline is presented as a beginning outline of physical, chemical and electrical processes and phenomena, and energy sources to be used in formulating a comprehensive Saline Water Research Program. The potential separation processes and phenomena and energy sources for demineralization are discussed. A chronological bibliography of demineralization methods containing 217 references is provided. An index of potential separation processes and phenomena, an index of potential energy sources for demineralization, an author index, and a patent index are included. (Davison-IPA)
W79-05655

THE PROPERTIES OF GAS HYDRATES AND THEIR USE IN DEMINERALIZING SEA WATER,
Syracuse Univ. Research Inst., NY.
A. J. Barduhn, H. E. Towlson, and Y-C. Hu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 031, Price codes: A04 in paper copy, A01 in mirofiche. OSW Research and Development Progress Report No. 44, September 1960. 73 p, 8 fig, 10 tab, 39 ref, 1 append. 14-01-001-177.

Descriptors: *Desalination, *Hydrates, *Hydrate processes, *Hydration, Physicochemical properties, Thermal properties, Physical properties, Demineralization, Sea water, Crystallation.

The properties of hydrate systems were studied by collecting data from the literature; experimental work on pressures and temperatures of which hydrates form; and by determining the other thermodynamic properties, such as heats of formation, composition, and effects of dissolved salt. More than 20 new compounds were screened by determining their critical decomposition temperatures and pressures; phase diagrams were worked out for three of the more promising hydrate formers: Freon 31 (CH2C1F), methyl bromide, and Freon 21 (CHC12F). Although these agents have good potentialities in a desalination process, work is continuing to find more suitable agents and to evaluate them. The properties of hydrates are examined and the experimental work is reported. (Davison-IPA)
W79-05656

DISPOSAL OF SALINE WATER CONVERSION BRINES -- AN ORIENTATION STUDY,
Louis Koenig - Research, San Antonio, TX.
L. Koenig.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 394, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 20, 1958. 115 p, 24 fig, 18 tab, 84 ref. 14-01-001-92.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

Descriptors: *Ultimate disposal, *Desalination wastes, *Brine disposal, Evaporation, Injection, Pipelines, Transportation, Saturation, Capital costs, Operating costs, Saline water, Salinity, Waste disposal, Waste treatment, *Costs.

The processes of potential use for the ultimate disposal of the waste brines resulting from conversion of saline water to fresh water were investigated. The twelve disposal processes considered, compounded out of eight unit operations, were: (1) pipeline to the sea; (2) solar evaporate the wastes to saturation and pipeline to the sea; (3) solar evaporate to complete dryness and convey by railroad to the sea; (4) pipeline to a land dump; (5) evaporate to saturation and pipeline to a land dump; (6) evaporate to dryness and freight to a land dump; (7) solar evaporate to dryness and abandon in situ; (8) inject the waste to underground formations; (9) solar evaporate to saturation and inject; (10) pipeline and inject in an abandoned oil well; (11) evaporate to saturation and pipeline to abandoned oil well; and (12) discharge to streams in times of flood. The costs of the unit operations were made for a standard set of parameters selected to represent the median values of the parameters to be expected in practice. The costs of one set of processes depends upon the concentration of the original waste, while the cost of another set is independent of the concentration. Each unit operation is discussed in terms of operating experience, investment costs, and operating costs. Each of the disposal processes is discussed; the cost of each is presented. (Davison-IPA)
W79-05657

THE STUDY OF IONIC SOLVATION,
Pennsylvania Univ., Philadelphia.
For primary bibliographic entry see Field 1A.
W79-05658

PRODUCING SELECTIVELY INFRARED-REFLECTING SURFACES ON PLASTIC FILMS FOR SOLAR STILLS,
Franklin Research Center, Philadelphia, PA.
R. A. Erb, E. Thelen, and F. L. Jackson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 035, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 53, October 1961. 36 p, 12 fig, 1 tab, 5 ref. 14-01-001-206.

Descriptors: *Desalination, *Desalination processes, *Solar distillation, *Solar stills, Infrared radiation, Coatings, Films, Feasibility, Economic feasibility, Technology, Research and development.

A discussion of the basic considerations of radiant energy behavior in solar stills is presented along with conclusions as to the limitations of still design on the use of selectively infrared-reflecting coatings. The two classes of infrared coatings examined are thin metal films and single and multiple-film types of interference reflection filters. It is generally concluded that metal films are not technically feasible because they will not conserve energy, and that while interference coatings are technically feasible, they are not economically feasible. (Davison-IPA)
W79-05659

DEVELOPMENT OF PLASTICS SOLAR STILLS.
Bjorksten Research Lab., Inc., Madison, WI.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 398, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 24, February 1959. 33 p, 12 fig, 2 tab, 1 append. 14-01-001-64.

Descriptors: *Desalination, *Desalination processes, *Solar stills, *Solar distillation, Desalination apparatus, Plastics, Films, Condensation, Distillation, Evaporation, Surfactants, Design criteria, Evaluation.

A research program testing plastic solar stills and plastic materials was conducted in the laboratory and out of doors in a southern climate similar to the climate of actual operation of solar distillation units. Rigid plastics were too expensive to use as construction materials, and testing of semi-rigid plastics was discontinued because of their low yield and brittleness. A standard greenhouse-type still was developed to evaluate plastic films under conditions simulating the working conditions of larger stills of the same type. Various surface active agents were applied to the surface of several plastics to provide a good wettable surface approaching that of well cleaned glass. The only material giving near the desired results was an alcohol solution of partially hydrolyzed polyvinyl acetate. After six months testing only the double layer of polyvinylidene-chloride-vinyl chloride copolymer remained in good condition although the film had darkened and the outer layer was almost opaque. Five other types of stills were designed and fabricated in the effort to produce a still of adequate design. The suspended envelope still was designed after evaluations of the previous designs revealed their operating difficulties and inefficiencies. The suspended envelope type still was considered to be the most practical because of its yield, ease of installation, wind resistance and ease of repair. (Davison-IPA)
W79-05660

DEMINERALIZATION OF SALINE WATER BY ELECTRICALLY-INDUCED ADSORPTION ON POROUS GRAPHITE ELECTRODES.
Oklahoma Univ., Norman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 129, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 45, September 1960. 58 p, 6 fig, 9 tab, 28 ref, 1 append. 14-01-001-160.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Demineralization, Anion, Cation, Electrodes, Electrochemistry, Electrolysis, Graphite, Acids, Water treatment, Water purification, Saline water, Carbon, Estimated costs, Cost analysis.

Anion-responsive electrodes were prepared from treated graphites and combined in demineralization cells with chemically improved cation-responsive electrodes. The goals of this investigation were to develop greater capacity for cation-responsive electrodes and to develop methods to achieve anion-responsive electrodes. Three approaches to the modification of the electrochemical properties of graphite were studied: the incidental or deliberate modifications imparted by the dispersing agent; severe chemical treatment, such as oleum or nitric-sulfuric acid mixture; and adsorption on the carbon of redox molecules with predictable electrochemical properties. Other variables investigated were different types of starting carbons and mechanical compression of electrodes. Cost estimates of saline water demineralization using the anion-reversible and cation-reversible electrodes fabricated from these chemically treated graphites deposited on Dacron felt were made. It is concluded that chemical treatment with concentrated sulfuric-concentrated nitric acids yielded the highest capacities; improved electrode characteristics were obtained through refinement of dispersion techniques; and the preliminary cost estimates indicated the economic feasibility of the process to be comparable to or less expensive than electrodialysis with ion exchange resins. (Davison-IPA)
W79-05661

FIRST ANNUAL REPORT: SALINE WATER CONVERSION PLANT NO 1, FREEPORT, TEXAS.
Stearns-Roger, Inc., Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 466, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 71, January 1963. 66 p, 6 fig, 2 tab, 2 append. 14-01-001-218.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, *Long-tube vertical multiple effect evaporation, Demonstration Plant No. 1, Freeport(Texas), Corrosion, Equipment, Sea water, Water treatment, Water purification, Research and development, Evaporation, Scaling, Water yield.

Technical, economic, and administrative evaluations of the Long-Tube Vertical (LTV) multiple-effect evaporation method of desalination employed by Demonstration Plant No. 1, Freeport, Texas, are reported for the period April 1961 to June 1962. The technical studies, primarily of the research and development type, were carried out during operation, maintenance and testing. The difficulties encountered during the period were due to equipment malfunctions, with equipment corrosion, brine carryover and misapplied equipment being the major areas hampering effective and sustained operation. Process malfunctions were very limited, and the few malfunctions that did occur were corrected by a combination of equipment and process modifications. Because of the malfunctioning equipment and unstable operating conditions, maintenance costs for this first year were higher than expected. Production costs vs production rates and operating costs vs production are illustrated in graphic form. Among the technical conclusions are: (1) carbon steel gives unsatisfactory service in heat exchanger tubes, tube sheets, baffles, and piping when exposed to non-deaerated sea water; (2) the specified paint for this plant is unsuitable for the corrosive atmosphere prevailing in the Freeport area; and (3) mill scale should be removed from the insides of the carbon-steel equipment by pickling before start up. Conclusions concerning the process and equipment are discussed. (Davison-IPA)
W79-05662

A STUDY OF LARGE SIZE SALINE WATER CONVERSION PLANTS.
Bechtel Corp., Los Angeles, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 470, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 72, March 1963. 156 p, 5 fig, 20 tab, 1 append. 14-01-0001-267.

Descriptors: *Desalination, *Desalination processes, *Desalination plants, *Design criteria, *Economic feasibility, Costs, Cost comparisons, Capital costs, Estimated costs, Electrodialysis, Long-tube vertical multiple effect evaporation, Multi-stage flash evaporation, Membranes, Membrane processes, Saline water, Sea water, Brackish water, Water purification, Water treatment.

The effect of plant size on the costs of producing fresh water from saline and brackish water was investigated through studying three types of demonstration plants in operation: the Long Tube Vertical (LTV) multiple effect evaporation process at Freeport, Texas; the Multi-stage Flash Evaporation (M-SF) process at San Diego, California; and the Electrodialysis (E/D) process at Webster, South Dakota. All three plants were normalized with respect to common design and site criteria; instrumentation was modified for automatic plant operations; and the data from predictable results of demonstration plant operations and the special test program were extrapolated for larger size production plants. To develop comparative alternative fuel costs for the larger size plants fuel oil costs of $2.00/barrel were assumed on the basis of large fuel deliveries, and natural gas fuel costs of $0.20/10 to the sixth Btu's were assumed. Cost estimates for the large size plants were based on the engineering designs, the vendor bids obtained for all major equipment, and experience bids from manufacturers. It is concluded that capital cost reductions occur as plant capacity increases. For example, increasing the size of a normalized M-SF plant by a factor of 14 reduces capital costs/unit output/day by 47%. Other conclusions are: water costs are reduced as plant capacity is increased; the most significant cost decrease results from using natural gas as the fuel; and product water was least expen-

sive from the larger sized M-SF plant utilizing natural gas. (Davison-IPA)
W79-05663

PRELIMINARY DESIGN OF AN EXPERIMENTAL CONTAINERIZED FREEZE DESALINATION UNIT,
Concentration Specialists, Inc., Andover, MA.
J. Fraser, and S. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A051 171, Price codes: A05 in paper copy, A01 in microfiche. Department of the Navy-Civil Engineering Laboratory, Port Hueneme, California, December 1977. 68 p, 27 fig, 9 tab, append.

Descriptors: *Desalination apparatus, *Design, *Freezing, *Potable water, *Costs, *Water supply development, Freeze desalination, Desalination, Equipment, Construction costs, Water sources, Sea water, Brackish water, Saline water, Salinity, Desalination processes, Water supply, Computer models, Model studies, Heat transfer, Heat exchangers, Melting, Washing, Pumps.

A preliminary design for a 20,000-gpd containerized indirect contact freeze desalination unit includes plans for a freezer with a defrosting cycle, a wash column, and an indirect contact melter, together with pumps, compressors, heat exchangers, and control. The project objective was to design an indirect contact freeze desalination unit able to process seawater into potable water conforming to EPA drinking water standards, and which would fit into an 8 x 20 ft ANSI container; the unit will be used at advanced military bases. Power consumption is estimated at 77 kw-hr/kgal at a nominal design point of 3.5% feed and 70F. Prototype construction cost is estimated at $280,000. The system is designed to operate with virtually any type of sea or brackish feed water. Projected performance data are given for feed salinities of 0.5-5.0%, and feed temperatures of 40-100F. Although the scraped-surface type of freezer, which eliminates ice build-up on the heat transfer surface by continuous mechanical removal, is commonly used in chemical process industries, capital and operating costs are both prohibitively high for desalting applications; a plain tube defrosted freezer is much more economical. A computer model was developed of the desalination process, which involves freezing the saline water into brine-coated pure ice crystals, washing off the brine, and melting the ice. A heat exchanger uses outgoing melt and brine to cool incoming water. (Lynch-Wisconsin)
W79-05727

RESEARCH ON ROLE OF LIGAND MOLECULES ON IONIZATION POTENTIALS,
United Science Associates, Inc., Pasadena, CA.
S. Naiditch, R. G. Suchannek, and R. A. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-199 105, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 223, December 1966. 103 p, 27 fig, 3 tab, 25 ref. 14-01-0001-424.

Descriptors: *Desalination processes, *Ionization, *Hall coefficients, *Ions, *Solvents, Solvation, Separation techniques, Energy, Cesium, Ammonia, Temperature, Electrolytes, Density, Ion transport.

To improve the understanding of the dissociation of simple ionic salts a new technique based on the preionization effect, was established for measuring the energy attachment of solvent molecules to positive ions. It was used to measure the energy of attachment of ammonia to the positive ions, Cs+, K+, and Na+. The results were applied to the ionization of cesium chloride in ammonia and to the solvation number of the cessium ion in ammonia. Hall effect measurements were taken to provide correlational data on the state of electrolytes in solution. Hall coefficient measurements versus temperature indicated a small variation of RH with increasing temperature. From the Hall coefficients it was possible to deduce the number density of charge carriers contributing to the change transport and the mobilities of the positive and negative ions. These deductions are valid in concentrated solutions. This report is in two sections: Section I contains energies of attachment and Section II contains Hall coefficients. (Davison-IPA)
W79-05864

INVESTIGATION OF CHELATION AS A MEANS OF REMOVING IONS FROM SEA WATER,
Southern Research Inst., Birmingham, AL.
R. E. Lacey, E. W. Lang, and C. E. Feazel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 260, Price codes: A02 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 42, March 1961. 21 p. 14-01-001-187.

Descriptors: *Desalination, *Pre-treatment(Water), *Chelation, *Scaling, *Economic feasibility, Resins, Water treatment, Ions, Separation techniques, Sea water, Solvent extractions, Immiscibility.

Four methods of using chelations as a treatment to remove the scale-forming ions from sea water prior to distillation processes for purification were studied: (1) forming water-insoluble chelates; (2) forming oil-extractable chelates; (3) using water-immiscible liquid ligands; and (4) chelating resins. According to the Office of Saline Water, the cost of this treatment should not exceed $0.10/1000 gallons of product water if the methods are to be commercially useful. The results of the study indicate that it is highly improbable that any of these methods can be economically feasible because of solubility and mechanical losses of chelating agent and resin. The possibility of complexing sodium ions as well as calcium and magnesium ions was studied. It is recommended that no further consideration be given to this because of the cost of solvent losses and the difficulty of economically regenerating sodium complexes. (Davison-IPA)
W79-05868

A STUDY AND DEVELOPMENT OF THE HICKMAN SEA-WATER STILL,
Battelle Memorial Inst., Columbus, OH.
W. L. Buckel, W. D. Beck, J. R. Irwin, A. A. Putman, and J. A. Eibling.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 030, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 43, September 1960. 152 p, 59 fig, 2 tab, 9 ref, 3 append. 14-01-001-104.

Descriptors: *Desalination, *Desalination apparatus, *Badger-Hickman still, *Economics, *Water costs, *Capital costs, *Heat transfer, Estimated costs, Operating costs, Evaporation, Condensation, Amortization, Wrightsville Beach(North Carolina), Pilot plants.

The research performed on the Hickman still from November 15, 1957 through April 30, 1960, is summarized. Experimental work on the fundamental heat transfer study was performed in the laboratory using a laboratory-size unit, No. 4 still. Pilot plant tests were carried out (using sea water) on the (17,000 gpd) Badger-Hickman No. 5 still at Wrightsville Beach, North Carolina. A brief historical account of work done before November 1957 and a detailed description of the experiments conducted on the No. 4 and No. 5 stills are presented. Estimated operating costs were based on Hickman stills utilizing a single rotor column of 100,000 gpd. Variables considered were capacity, operating temperature, temperature difference between evaporating and condensing media, and rotor speed. Minimum operating costs based on a life of 20 years for the entire still were estimated at $1.02, $1.03, and $1.07/1000 gallons for evaporating temperatures of 150F, 120F, and 90F respectively. Corresponding capital costs were $1.78, $1.85, and $1.78/gallon/day of production. The discussion of evaporation-condensation heat transfer across a rotating surface includes the fundamentals of heat transfer of a rotating disk, overall heat transfer coefficient of a rotating disk, and the effect of operating conditions on heat transfer coefficients. It is concluded that the two items contributing most to the cost of product water are power and evaporator amortization. (Davison-IPA)
W79-05869

CORROSION OF METALS IN SEA WATER,
Battelle Memorial Inst., Columbus, OH.
F. W. Fink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 344, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 46, December 1960. 62 p, 14 fig, 3 tab, 40 ref. 14-01-001-182.

Descriptors: *Corrosion, *Sea water, *Saline water, *Brackish water, *Pitting, *Desalination, *Metals, *Publications, Alloys, Ions, Conduction, Heat transfer, Temperature, Scaling, Steel, Iron, Aluminum, Copper, Nickel, Titanium.

The corrosion behavior of metals and other materials in sea water, diluted sea water and brackish waters was studied, with particular attention given to corrosion and scaling problems resulting from heating saline waters. Information was obtained from literature, consultations with corrosion experts, marine corrosion research, manufacturers' technical publications and Battelle Memorial Institute's marine experience. The interaction of the major factors which influence corrosive reactions is complex and none of them are considered solely in analyzing a situation. The following factors are discussed: corrosive ions, particularly chloride; conductance and salt concentration; oxygen and temperature; crevice and pitting attack; sea water flow velocity transfer; and galvanic couples. Scaling problems associated with the chemical changes occurring when sea water is heated are reviewed. The following metals are examined with regard to their performance in saline water: steel; cast iron; wrought iron; aluminum and its alloys; copper; brasses and bronzes; cupro nickels; monel stainless steels; titanium; and the special alloys, Hastelloy C and Iconel. It is concluded that the rate of attack is increased by an increase in sea water temperature; higher temperatures are generally associated with more local attack, such as pitting; and that each metal and each type of environment must be considered individually. A bibliography containing 112 entries, chronologically arranged, is provided. (Davison-IPA)
W79-05870

A NEW PROCESS FOR THE PRODUCTION OF FRESH WATER FROM SEA WATER,
Struthers Wells Corp., Warren, PA.
H. Svanoe, W. F. Swiger, J. S. Colton, J. E. Jewett, and I. B. Margiloff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 840, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 47, June 1961. 67 p, 21 fig, 4 tab. 14-01-001-189.

Descriptors: *Desalination, *Desalination processes, *Freezing, *Struther Wells-Scientific Design process, Desalination apparatus, Crystals, Crystal growth, Crystallization, Nucleation, Demineralization, Separation techniques, Capital costs, Operating costs, Ice, Ice-brine systems, Pilot plants, Cooling, Sea water, Water purification, Water quality, Corrosion, Scaling.

A process has been developed which successfully produces fresh water from sea water by employing direct contact between saline water and a hydrocarbon refrigerant. The Struthers Wells - Scientific Design (SW-SD) process uses techniques of controlled crystallization to produce large, uniformly sized, regularly shaped pure ice crystals. The requirements for the proper conditions to create these crystals include minimum brine undercooling, the presence of a large mass of crystals in the undercooling zone, limited nucleation, and turbulent flow to obtain good contact between undercooled brine and suspended ice crystals. Another feature of the process is conservation of energy. The SW-SD process is described and the theory of

crystallization is reviewed. Capital and operating costs for a 10 million gallon per stream day plant are developed using the Office of Saline Water Standardization Procedure and Scientific Design Company procedure. An experimental program carried out with the pilot plant is discussed. It is concluded that: the degree of brine undercooling, slurry density, liquid velocity, and a slow approach to operating temperature at startup are important elements to control in making good crystals in an efficient manner; this freezing process is one of the lowest cost methods of converting sea water to drinking water; and although there was no evidence of corrosion or calcium bicarbonate scaling, these cannot be ruled out as future problems. (Davison-IPA)
W79-05871

INVESTIGATION OF SUPERSATURATION IN SALINE WATER CONVERSION,
Ionics Inc., Cambridge, MA.
R. M. Lurie, M. E. Berg, and A. Guiffrida.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 261, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 48, February 1961. 59 p, 13 fig, 12 tab, 102 ref. 14-01-001-180.

Descriptors: *Desalination, *Electrodialysis, *Supersaturation, *Effluents, *Calcium sulfate, Stability, Additives, Chemical precipitation, Laboratory tests, Nucleation, Flocculation, Desalination processes, Desalination plants, Water treatment, Separation techniques, Conductivity.

A literature survey and an investigation of additives in stirred flasks were employed to determine the conditions which control the allowable level of supersaturation of calcium sulfate in the waste stream of electrodialysis demineralizers. The stirred flask experiments, encompassing eight variables, were used to study the stability of calcium sulfate in supersaturated solutions, destabilizing materials, and solution conductivity. The amount and location of precipitate as a function of operating variables and additives were investigated using a laboratory electrodialysis unit. The Mark II-4, a commercial unit, was successfully operated; results from two other commercial units that performed satisfactorily under supersaturated conditions are reported. It is concluded that: supersaturated solutions cannot be handled in electrodialysis units without stabilizing additives; supersaturated calcium sulfate solutions can be readily destabilized with alum or cellulosic flocculating agents, electrically or by heating; current density has some affect on the allowable level of supersaturation, but flow rate and holdup are unimportant; two different salt compositions behaved alike at the same level of supersaturation; and the precipitation of the salts in the electrodialysis unit in finely divided form may be possible to prevent clogging of the flow paths. (Davison-IPA)
W79-05872

VAPOR COMPRESSION WITH SECONDARY HEAT-TRANSFER MEDIA.
Ferguson (H. K.) Co., New York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 090, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 56, December 1961. 124 p, 8 fig, 14 tab, 3 ref, 1 append. 14-01-001-209.

Descriptors: *Desalination, *Desalination processes, *Vapor compression distillation, *Heat transfer, *Secondary heat transfer media, Compression, Costs, Cost estimates, Capital costs, Operating costs, Evaporation, Separation techniques, Water treatment, Water purification, Water quality, Saline water.

Three basic distillation processes are compared in an investigation of the use of vapor compression with a secondary fluid. The units were compared with maximum operating temperatures of 160F and 212F. Compression ranges, distillation rates, heat transfer, energy requirements and costs are given for the standard vapor compression cycle, multiple effect evaporators, vapor compression with multiple-effect evaporators, and a vapor compression unit with secondary fluid. Capital and operating costs were developed for the various units operating at 160F with surface costs of $8.10 and $6.72/sq ft, heat transfer coefficient of 500, steam costs of $.55/1000 lbs for compression units and $.0318/1000 lbs for the multiple-effect evaporator. The results of the investigation indicate that a vapor-compression type unit producing water by distillation from fuel yields the lowest cost product. A vapor compression cycle using a secondary fluid produces lower cost water than the cycle compressing water vapor. The freon compression unit costs are higher than the multiple-effect evaporator. It is concluded that the compression cycle using a secondary fluid warrants consideration as a means of saline water conversion. (Davison-IPA)
W79-05873

EVALUATION OF A THIN-FILM SEA WATER DISTILLATION UNIT FOR MARINE AND SHORE BASE APPLICATION.
General Electric Co., Burlington, VT.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 041, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 54, October 1961. 155 p, 61 fig, 5 tab, 3 append. NObs-78202(1734 A).

Descriptors: *Desalination, *Desalination apparatus, *Thin films, *Fluted-tube wiped film evaporator, Evaluation, Distillation, Heat transfer, Water purity, Temperature, Scaling, Condensation, Desalination processes, Water purification, Water treatment, Separation techniques.

The fluted tube, wiped-film evaporator was tested and evaluated to determine its characteristics and capabilities. Performance and anti-scaling capabilities were determined in investigating the best combination of factors in the evaporator which will ultimately lead to a compact distillation apparatus for marine use. Details of the work in the following areas are presented: investigations of the evaporating and condensing surfaces; overall performance; a 130 hour run on natural sea water to determine service heat transfer performance; a 24 hour record of capacity and purity of fresh water; and an estimate of the volumetric size of an 8,000 gpd distillation plant based on the overall surface heat transfer coefficient obtained after the 130 hour run. The conclusion include: a constant high rate of distillation was achieved by the unit operating on sea water at an overall temperature difference of 27F and temperature of 170F; product purity of less than 1 ppm was achieved; the brine distillate ratio of 1.35 was adequate to maintain the performance; approximately 1/4 HP total wiper power would be required by an 8,000 gpd still; and an 8,000 gpd two-effect thin film evaporator for marine application would require a space 4 ft x 4 ft x 6-1/2 high. (Davison-IPA)
W79-05874

RESEARCH ON THERMOELECTRIC HEAT PUMPS,
Whirlpool Corp., St. Joseph, MI. Research Labs.
E. F. Cox.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 543, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 79, November 1963. 41 p, 13 fig, 2 tab. 14-01-001-256.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Heat pumps, Conductivity, Electrical conductance, Resistivity, Conductors, Distillation, Water treatment, Equations, Materials, Electrical resistance, Thermal conductivity, Heat transfer.

The adaptation of heat pumps based on the Peltier principle to distillation processes is discussed. These heat pumps require two dissimilar materials which have low electrical resistivity and low thermal conductivity; both materials should have large 'thermoelectric power' of opposite sign. Since these pumps have no mechanical moving parts and work best against small temperature differential, they would be advantageous in distillation processes. Mathematical calculations and physical theory are used to prove that usage of Peltier semiconductor materials in a large distillation plant may not be cost prohibitive. Four potential methods of fabricating and joining short thermoelements are considered. Pyrolysis experiments and cathodic sputtering of thermoelectric semiconductors are examined. A construction method for short-element Peltier thermal pumps is explained. It is concluded that theoretically Peltier thermal pumping appears promising in improving the efficiency of distillation processes. (Davison-IPA)
W79-05875

DEMINERALIZATION BY TRANSPORT DEPLETION,
Southern Research Inst., Birmingham, AL.
R. E. Lacey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 544, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 80, November 1963. 91 p, 23 fig, 7 tab, 18 ref, 1 append. 14-01-001-229.

Descriptors: *Desalination, *Desalination processes, *Transport depletion, Membrane processes, Ion transport, Membranes, Cation exchange, Anion exchange, Separation techniques, Water treatment, Quality control, Water quality control, Water purification.

Transport depletion, a variant of electrodialysis, uses only one type of ion exchange membrane, either a cation-permeable or anion permeable. The enriched solutions are separated from the depleted solutions by films permeable to both cations and anions. Part A summarizes the important findings from November 1, 1961 to October 31, 1962. In Part B the experiments are reported in detail; descriptions of the apparatus, techniques and difficulties are included. Appreciable demineralization occurred in the transport depletion process. The new type of sleeve construction developed overcomes the disadvantage of stagnant liquid layers between membranes and sleeves of the original design; it retains the advantage of almost 100% membrane utilization and lower cost construction. Theoretical expressions were developed that described the measurable parameters of performance, however, experiments indicated that some parameter or parameters not accounted for in the theoretical expression strongly influenced demineralization performance. Cost data indicate that the transport depletion process has the potential to demineralize water at a lower cost than electrodialysis, and that it will eliminate the difficulties of polarization damage to anion-permeable membranes. (Davison-IPA)
W79-05876

AN INVESTIGATION OF THE USE OF ACOUSTIC VIBRATIONS TO IMPROVE HEAT TRANSFER RATES AND REDUCE SCALING IN DISTILLATION UNITS USED FOR SALINE WATER CONVERSION,
Southwest Research Inst., San Antonio, TX.
I. A. Raben, G. Commerford, and R. Dietert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 911, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 49, March 1961. 163 p, 46 fig, 26 tab, 18 ref, 2 append. 14-01-001-188.

Descriptors: *Desalination, *Acoustics, *Vibrations, *Heat transfer, *Desalination processes, *Desalination apparatus, Distillation, Reynolds number, Flow, Turbulant flow, Films, Scaling, Calcium sulfate, Sea water, Viscous flow, Boiling, Water treatment, Separation technique, Laboratory tests.

The technical feasibility of using acoustic energy to improve the economy of evaporator operation in saline water conversion has been demonstrated.

The improvement in water side heat transfer coefficients using acoustic vibrations in the viscous and turbulent flow ranged from 450% at a Reynolds number of 540 to 16% at a Reynolds number of 6,000. It is felt that by utilizing larger vibration equipment greater improvement can be obtained at higher flow Reynolds numbers. Data obtained with the experimental unit were correlated using both vibration and flow Reynolds number parameters. The study of acoustic vibration effects on steam condensate film heat transfer coefficient showed a 57% improvement in the heat transfer coefficient at a frequency of 75 cps and an amplitude of 0.2 in, which represents a potential 30% increase in evaporator capacity. The effect of vibration on the formation of scale on a heat transfer surface under boiling and nonboiling conditions was evaluated using calcium sulfate and sea water as scaling liquors. Vibration caused the scale to flake from the pipe surface, and improved heat transfer coefficients under boiling conditions. Better scale removal was obtained under nonboiling conditions. (Davison-IPA)
W79-05877

THE MECHANISM OF DESALINATION BY REVERSE OSMOSIS,
Aerojet - General Corp., Azusa, CA.
B. Keilen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 571, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 84, November 1963. 73 p, 18 fig, 8 tab, 52 ref, 1 append. 14-01-0001-272.

Descriptors: *Desalination, *Reverse osmosis, *Membranes, Cellulose acetate, *Fabrication, Membrane processes, Salt, Salt balance, Temperature, Physical properties, Osmotic pressure, Chemical properties, Desalination processes, Laboratory tests, Desalination apparatus, Water treatment, Separation techniques, Demineralization.

A program with the objectives of (1) understanding the mechanism whereby desalination is accomplished by the cellulose membrane, and (2) clarifying the role of each of the fabrication parameters affecting the flux and desalination characteristics of the finished membrane is reported. The principal fabrication parameters of useful desalination membranes are: (1) composition of the casting solution; (2) temperatures at which casting, drying, and immersion of the membrane are effected; (3) thermal soak as a post-treatment of the cast membranes; and (4) application of the pressure to the membrane during its use. Each of these parameters is discussed in detail and explained in terms of experimental data. The presence or absence of the membrane salt has a major effect on the flux; deviation from the following casting solution ratios has a marked but lesser effect on membrane capability: cellulose acetate, 22%; acetone, 67%; water, 10%; and membrane salt, 1%. Temperatures critical to optimum membrane capability at which casting, drying and membrane immersion are effected are: casting, -11C; drying, -11C; and immersion, 0C. A description of a proposed mechanism for water transport and the experimental evidence developed in support of the hypothesized mechanism are presented. (Davison-IPA)
W79-05878

STUDY OF ORIENTED CELLULOSE MEMBRANES FOR REVERSE OSMOSIS AND THE RELATIONSHIP BETWEEN MORPHOLOGY AND SALT REJECTION,
Gulf South Research Inst., New Orleans, LA.
J. K. Smith, F. Morton, and E. Klein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 920, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 507, February 1970. 106 p, 22 fig, 16 tab, 30 ref, 3 append. 14-01-0001-1271.

Descriptors: *Reverse osmosis, *Membranes, *Structure, *Desalination, *Cellulose, Tensile strength, Mechanical properties, Chemical properties, Physical properties, Osmosis, Permeability, Films, Thin films, Water treatment, Separation techniques, Diffusion, Selectivity.

The water and solute permeabilities of regenerated cellulose films having high degrees of orientation were studied. Orientation was induced to increase the tensile strengths of the films when wet and to substitute a homogenous surface for the cellulosic pore structure. To retard regeneration and facilitate orientation, the films were prepared by two modifications of the viscose process. It was found that the structure, of the films was affected strongly by composition of the cellulose xanthate solution, composition of the coagulation and regeneration bath, and by the method of fixation. Reverse osmosis and measurements of direct osmosis, hydraulic permeability, and diffusion rates were used in characterizing solute and solvent transport. Membrane gel properties wee described by gel water content measurements, phase contrast microscopy, electron microscopy and birefringence measurements. Membrane thickness was determined by a interferometer method when the samples were wet. Cross-linking agents and monofunctional substituents were used in chemical modifications of oriented membranes. Ultrathin membranes were studied on films prepared with a reactive polymer base. Acetylation of the oriented membranes was rapid and simple; loss of orientation was minor. It is concluded that mixed ethers of cellulose offer the potential of selectivity with better mechanical and biological stability. (Davison-IPA)
W79-05879

SALINE WATER CONVERSION BY FREEZING: AN INTERGRAL PROCESSING UNIT USING A SECONDARY REFRIGERANT,
Cornell Univ., Ithaca, NY. School of Chemical and Metallurgical Engineering.
H. F. Wiegandt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 906, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 41, August 1960. 51 p, 22 fig, 4 tab, 13 ref. 14-01-001-107.

Descriptors: *Desalination, *Desalination processes, *Freezing, *Desalination apparatus, Crystallization, Melting, Thermodynamics, Energy transfer, Hydrates, Hydraulics, Costs, Water costs, Capital costs, Separation techniques, Water treatment, Water purification, Saline water, Sea water.

The component parts of the freezing process as a method of desalination are considered separately, but with the intention that they will combine to permit operation as a single integral unit. An examination of the energy relationships and requirements of the freezing process is followed by a discussion of crystallization, washing and melting. These three components were selected for their simplicity, thermodynamic efficiency, potential for large scale operation and their compatibility to be incorporated into an experimental unit. In the design of a 10 million gpd plant the washing zone serves as a hydraulic seal between the freezing and melting zones. The unit also features a rapid freezing step, a washing operation wherein the ice bed is propelled by a hydraulic piston action, and a melting step in which the refrigerant, isobutane, is condensed directly on dumped bulk ice. This plant, requiring 11.8 Btu/lb of product, has an estimated product cost of $0.38/1000 gallons; the plant cost is equivalent to $0.67/daily gallon. (Davison-IPA)
W79-05880

RESEARCH ON SALT WATER PURIFICATION BY FREEZING,
Applied Science Labs. Inc., State College, PA.
A. Rose, and T. B. Hoover.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 382, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 7, September 1955. 57 p, 11 fig, 19 tab. 14-01-001-69.

Descriptors: *Desalination, *Desalination processes, *Freezing, *Ice-water interfaces, Entrainment, Brines, Crystallization, Laboratory tests, Cooling, Filtration, Separation techniques, Water purification, Water purity, Melting, Water treatment, Saline water, Sea water.

In the absence of information regarding the events which take place during partial freezing of saline water, systematic small-scale partial freezing experiments were undertaken. Variations were made of the cooling rate, the length of the cooling period, the type of agitation, the material and size of the container, and the initial concentration of the salt solution. The ice was separated from the solution in each experiment by draining or filtration, with ice melting reduced to a minimum. The weights of the original salt solution, the mother liquor, the filtered ice and entrained liquid were determined. The salt content of both the ice and the mother liquor was determined; limited value was given to experiments unless substantially all the original water and salt were accounted for in the products. Other experiments were conducted using counter current washing, filtration with filter cakes of varied thicknesses, surface active agents, and centrifuging. The conclusions drawn relate to (1) the presence of entrained or adhering mother liquor as the source of salt contamination; (2) the degree of contamination of the filtered or drained ice; (3) the rate of formation of actual ice; (4) the inherent lack of reproducibility of the draining and filtration operations; and (5) the similarity of results with natural sea water and a 3.5% solution of NaCl in water. (Davison-IPA)
W79-05881

RESEARCH ON CONDENSATION MECHANISMS,
Sigmatron, Inc., Santa Barbara, CA.
G. N. Steele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-184 986, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 215, October 1966. 41 p, 8 fig, 1 tab, 17 ref, 1 append. 14-01-0001-419.

Descriptors: *Desalination, *Condensation, *Separation techniques, *Two dimensional gases, *Adsorption, Physical properties, Chemical properties, Laboratory equipment, Density, Theoretical analysis, Investigations, Water treatment, Desalination apparatus.

A study and an experimental program investigating the nature of the two dimensional gas adsorbed on solid surfaces and its role as an additional state of matter interposed between gases and solids are reported. Theoretical investigations of early work in condensation are discussed and properties of two and three dimensional gases are compared. The goals of the experimental program undertaken were not achieved because of developmental problems in constructing and operating the equipment to be used. The operation and design of the ultra high vacuum system developed for this experimental program are described. Improvements in the equipment and employment of radioactive material are recommended before the desired adsorption data can be obtained. (Davison-IPA)
W79-05882

SEAWATER DISTILLATION APPARATUS,
H. S. Green.
U.S. Patent No. 4,131,513, 7 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 4, p 1212, December 26, 1978.

Descriptors: *Patents, *Desalination, *Sea water, *Water treatment, *Water purification, *Desalination processes, Distillation, Solar distillation, Condensation, Separation techniques, Desalination apparatus.

The seawater distillation apparatus is stationarily mounted relative to a seawall and includes operational components mounted on a float which may rise and fall with the tide of the associated body of seawater. The seawater distillation apparatus uti-

lizes electric energy as the source of heat to vaporize the seawater to be distilled. It is possible to provide the necessary electrical energy to power the apparatus from solar energy sources as well as domestic electrical energy sources. (Sinha-OEIS)
W79-05958

3B. Water Yield Improvement

BIOLOGICAL RECOVERY VERSUS DESERTIZATION,
International Livestock Centre for Africa, Addis Ababa (Ethiopia).
H. N. Le Houerou.
Economic Geography, Vol. 53, Vol. 4, p 413-420, Oct. 1977. 2 tab, 21 ref.

Descriptors: *Biodegradation, *Grazing, *Cultivation, *Irrigation practices, Saline water, Shelterbelts, Entropy, Soil moisture, Monitoring, Vegetation establishment, Reforestation, Droughts, Moisture deficit.

Desertization, a term this author prefers to the more generally recognized desertification, is analyzed here as being the result of overgrazing, overcultivation, cutting and uprooting of woody species, repetitious wildfires, and salinity or alkalinity from faulty irrigation methods. Examples of both natural and artificial recovery mechanisms from these man-animal induced pressures are discussed. Natural recovery, based on stability, resilience and entropy, depends on such biological and non-biological conditions as seed availability, soil permeability, depth and storage capacity of available moisture. Artificial means for speeding up natural recovery include increasing soil moisture retention, fertilization, ploughing, seeding species not present in the natural vegetative cover, rural village afforestation, dune stabilization, better use of saline soil and water. Water intake may be improved especially on medium to fine textured soils by scarification, contour terracing, water spreading, or by breaking hardpans such as calcrete or caliche. These interventions usually speed up biological recovery by years, but the author warns that their applicability to large-scale operations must be carefully assessed as to their economic feasibility. The use of saline water for irrigation of highly resistant fodder species is under study in several areas, but require efficient drainage systems. He is dubious about the efficacy of so-called greenbelts on a wide scale, and recommends monitoring programs to quantify what are presently scattered and qualitative observations. (Tickes-Arizona).
W79-05556

3C. Use Of Water Of Impaired Quality

AN OUTLINE OF SOIL, WATER AND AGRICULTURE IN ARAB COUNTRIES,
Alexandria Univ. (Egypt). Dept. of Soil Science.
For primary bibliographic entry see Field 2A.
W79-05553

EFFLUENT IRRIGATION OF COASTAL BERMUDA GRASS,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
A. R. Overman.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE1, Proceedings Paper 14359, p 55-60, February 1979. 2 fig, 4 tab, 14 ref. EPA S800829.

Descriptors: *Florida, *Irrigation, *Sewage effluents, Waste treatment, Land reclamation, Nutrients, Effluents, Bermuda grass, Nitrogen, Phosphorus, Potassium, Weeds, Water reuse, Groundwater, Water table, Grasses, Sands, *Tallahassee(FL), Wastewater use.

Secondary effluent from the city of Tallahassee, Florida, was applied to coastal bermuda grass on lakeland fine sand. Effluent was applied through sprinklers at rates of 50 mm/week, 100 mm/week, 150 mm/week, and 200 mm/week during the period April-October. Yields and nutrient recovery were determined. Yields and nutrient uptake showed an increase with irrigation rate, while efficiency of nutrient recovery decreased. The content (dry weight basis) of dry matter, nitrogen, phosphorus, and potassium increased with irrigation rate. Recovery efficiencies for calcium, magnesium, sodium, iron, and zinc were all below 100%, indicating adequate quantities of these elements. Based on these results, nitrogen recovery of 50% to 75% would be expected at 50 mm/week irrigation rate. With proper weed control, yields of 13 mtons/ha would be expected, with a harvest frequency of approximately 4 weeks. Supplemental potassium might be required since the K/N ratio of effluent usually lies below that of coastal bermuda grass. (Visocky-ISWS)
W79-05624

POTENTIAL USE OF CONVERTED SEA WATER FOR IRRIGATION IN PARTS OF CALIFORNIA AND TEXAS,
Bureau of Reclamation, Washington, DC.
For primary bibliographic entry see Field 3A.
W79-05645

SALT TOLERANCE IN THE WILD RELATIVES OF THE CULTIVATED TOMATO: RESPONSES OF SOLANUM PENNELLII TO HIGH SALINITY,
Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W79-05813

GRAPEFRUIT RESPONSE TO VARIABLE SALINITY IN IRRIGATION WATER AND SOIL,
Agricultural Research Organization, Bet-Dagan (Israel). Div. of Environmental Physiology.
H. Bielorai, J. Shalhevet, and Y. Levy.
Irrigation Science, Vol. 1, No. 1, p 61-70, August, 1978. 3 fig, 4 tab, 16 ref.

Descriptors: *Irrigation effects, Irrigation water, *Salinity, *Crop response, Grapefruit, Osmotic pressure, Salts, Leaching.

Results were reported from a long-term field experiment designed to determine the effect of irrigation water salinity on the yield and water uptake of mature grapefruit trees. Treatments were started in 1970 and consisted of chloride concentrations in the irrigation water of 7.1, 11.4 and 17.1 meq/l added as NaCl + CaCl2 at a 1:1 weight ratio. For the last four years of the experiment, 1973 to 1976, yield was linearly related to the mean chloride concentration in the soil saturation extract weighted according to the distribution of water uptake with depth and time. There was a 1.45% yield reduction for each 1 meq/l increase in chloride concentration above a threshold value of 4.5 meq/l. This corresponded to a 13.5% decrease per 1 mmho/cm increase in the electrical conductivity of the soil saturation extract above a threshold value of 1.2 mmho/cm. Total water uptake was reduced as salt concentration in the soil increased. Salt accumulation in the soil depended on the quantity and salt concentration of the irrigation water, rainfall, and on the amount of leaching. No leaf symptoms of either Cl(-) or Na(+) injury were observed. The results indicate an osmotic--rather than a specific ion effect--of salinity on grapefruit yield. (Skogerboe-Colorado State)
W79-05814

POTENTIAL FOR USING SALINE WASTE WATER FROM ELECTRICAL POWER PLANTS FOR IRRIGATION,
Utah State Univ., Logan. Dept. of Soils and Biometeorology.
R. J. Hanks, R. F. Nielson, R. L. Cartee, S. E. Ging, and P. McNeil.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 541, Price codes: A03 in paper copy, A01 in microfiche. Utah Agricultural Experiment Station Bulletin 504, March 1979. 33 p, 5 fig, 12 tab. OWRT A-037-UTAH(1). 14-34-0001-8047.

Descriptors: *Saline water, Impaired water, *Water reuse, Irrigation water, Salinity, Utilities.

Saline waste water from the Huntington, Utah Power and Light Company plant was used to irrigate 12 crops in 1977 and 1978. Variable amounts of irrigation were applied using a line-source irrigation system. In 1978 an identical plot was established which was irrigated with fresh water from Huntington Creek. There was no decrease in crop production caused by using the saline water as compared with fresh water. There were no measurable increases in soil salinity to a depth of about 1.2 m in either plot (as measured by electrical conductivity of a saturated paste) from spring to fall in 1978 but a slight increase was measured in 1977. Solution samples taken from the soil at about 1.2 m using ceramic samplers showed evidence of a slight increase in the electrical conductivity in 1977 but not in 1978. Thus, there is evidence of chemical reaction of the soil with the saline irrigation water that caused the electrical conductivity of the root zone to remain relatively low. This is especially true in that part of the plot which was not leached. Based on the two years of field data collected, it appears feasible to use the saline waste water from the plant for irrigation for several years. When excessive soil salinity will develop is not predictable from present knowledge.
W79-05829

3E. Conservation In Industry

WATER AND ENERGY IN THE WESTERN COAL LANDS,
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 6D.
W79-05845

3F. Conservation In Agriculture

EFFECTS OF WATER MANAGEMENT AND SOIL PHYSICAL PROPERTIES ON COTTON PRODUCTION IN THE ROLLING PLAINS,
Texas A and M University, College Station.
C. J. Gerard, and L. E. Clark.
Texas Agricultural Experiment Station, Publication No. MP-1382 C, June, 1978. 26 p, 5 tab, 11 fig, 17 ref.

Descriptors: *Soil-water-plant relationships, *Water utilization, *Soil physical properties, *Irrigation effects, *Cotton, Soil moisture, Soil compaction, Soil physics, Water management(Applied), Statistical analysis, Nitrogen, Storage capacity, Climatic data, Semiarid climates, Texas.

Cotton has long been a major crop on the semi-arid Texas rolling plains and numerous studies have sought to determine the best water management systems for getting the highest yields from limited amounts of irrigation water. Reported here are the results of a moisture level-variety-fertility experiment which was conducted with cotton on abilene clay loam soil in 1976. Four moisture levels were randomized in a Latin Square design and split to include two varieties, Lockett 77-4 and Lankart 611 and three nitrogen treatments, 0, 40, and 80 pounds of N/A. Results indicated that cotton exploits only a shallow reservoir of water on many soils on the rolling plains and yields were a linear function of water additions through irrigation or rainfall during the blooming and fruiting period. Compacted soil layers were found to reduce root growth and development and the shallow storage reservoirs on many of rolling plains soils must be replenished by rainfall or irrigation every 5 or 7 days during blooming and fruiting periods. Based upon climatological records of the area the target date for cotton planting is established to be about May 20 and tests have indicated that the Lockett 77-4 variety yields better than Lankart 611 for the area. Production practices in this region have been based largely upon tradition and further research

on water, insects, and soil management, and variety trials are recommended. (Tickes-Arizona)
W79-05557

CORN YIELDS FROM IRRIGATION WITH ADEQUATE AND DEFICIENT WATER,
Nebraska Univ., North Platte. Dept. of Agricultural Engineering.
W. F. Kroutil.
Paper No. 78-2555, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 19 p, 11 fig, 2 tab, 25 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Corn, Moisture deficit, Yield equations, *Crop response, Growth stages, Evapotranspiration, Water conservation, *Irrigation efficiency.

In 1974 and 1975, the effects of varying the time and the amounts of applied irrigation water on corn yield were studied on field plots at Fort Collins, Colorado. A single irrigation sprinkler line extending through the center of each plot provided the sole source of irrigation water. With this irrigation design, the corn experienced greater water deficiency outward from the sprinkler line. In addition, irrigation water was withheld from some treatments during various growth periods throughout the season. The field plots were preplant irrigated to wet the soil profile to a depth in excess of three meters. Primary comparisons were made of actual and/or relative yields of grain and dry matter for different water application amounts and for evapotranspiration. Omitting irrigation water during certain growth periods generally reduced yields. High soil water holding capacity reduced the necessity for frequent irrigation. Omitting all irrigations during two growth periods reduced yields substantially. Omitting irrigations was not always detrimental if adequate water was available in the soil profile to maintain adequate evapotranspiration. Of major significance was the result that, with few exceptions, regular application of less irrigation water than that required for maximum evapotranspiration produced the best water use efficiencies expressed as yield-per-unit of water consumptively used. (Skogerboe-Colorado State)
W79-05803

VARIABILITY OF SPRINKLER COEFFICIENT OF UNIFORMITY TEST RESULTS,
RainBird Technical Services, Logan, UT.
K. Solomon.
Paper No. 78-2010, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 10 p. 2 fig, 2 tab, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Uniformity coefficient, Irrigation efficiency, Statistical methods, Regression analysis.

Sprinkler coefficient of uniformity (UC) test results were analyzed and found to vary significantly, even under similar test conditions. The amount of anticipated variation in measured UC values was correlated with the UC value itself. Factors influencing this variation were discussed. (Skogerboe-Colorado State)
W79-05805

GRAPEFRUIT RESPONSE TO VARIABLE SALINITY IN IRRIGATION WATER AND SOIL,
Agricultural Research Organization, Bet-Dagan (Israel). Div. of Environmental Physiology.
For primary bibliographic entry see Field 3C.
W79-05814

ANALYSIS OF TRICKLE IRRIGATION WITH APPLICATION TO DESIGN PROBLEMS,
Agricultural Research Organization, Bet-Dagan (Israel). Div. of Soil Physics.
E. Bresler.
Irrigation Science, Vol. 1, No. 1, p 3-17, August, 1978. 6 fig, 1 tab, 18 ref.

Descriptors: *Irrigation design, Water conservation, *Trickle irrigation, Flow rates, Infiltration.

An existing numerical solution to nonsteady state infiltration was used to quantify the effect of soil hydraulic properties and trickle discharge rates on emitter spacing. The results of the analysis suggested the possibility of controlling the wetted volume of a soil by regulating the emitter discharge according to soil properties. The surface distribution of a transformed soil water content (or pressure) function was derived from a linearized solution to steady infiltration. The analysis of steady and nonsteady infiltration was employed to estimate the spacing between emitters as a function of discharge and water pressure conditions between emitters using hydraulic soil data. Hydraulic conductivity parameters were given for 17 different soils which were used for design purposes. Theoretical analysis of soil water was combined with hydraulic principles to derive lateral diameter and length for engineering design requirements. (Skogerboe-Colorado State)
W79-05815

A NOTE ON THE ECONOMIC SIGNIFICANCE OF UNIFORM WATER APPLICATION,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
I. Seginer.
Irrigation Science, Vol. 1, No. 1, p 19-25, August, 1978. 3 fig, 7 ref.

Descriptors: *Water delivery, Prices, Costs, *Crop production, *Sprinkler irrigation, Yield equations.

A yield vs water application diagram, with uniformity of water-distribution and price of water as parameters, can be used to determine the optimum water application and the expected income for a certain crop. The diagram can further be used to explore the possible outcome of changing water uniformity and/or price. The diagram was based on simplified forms of the yield and water-distribution functions. (Skogerboe-Colorado State)
W79-05816

THE EFFECT OF SUPPLEMENTAL IRRIGATION AND NITROGEN FERTILIZATION ON WHEAT (TRITICUM AESTIVUM L.),
Agricultural Research Organization, Gilat (Israel). Regional Experiment Station.
For primary bibliographic entry see Field 2I.
W79-05817

CENTER PIVOT IRRIGATION IN THE COLUMBIA BASIN OF WASHINGTON AND OREGON: DYNAMICS AND IMPLICATIONS,
Oregon State Univ., Corvallis. Dept. of Geography.
K. W. Muckleston, and R. M. Highsmith.
Water Resources Bulletin, Vol. 14, No. 5, p 1121-1128, October 1978. 1 fig, 13 ref.

Descriptors: *Sprinkler irrigation, Columbia River, Hydroelectric power, Water law, Oregon, Washington, Social impact, Economic impact.

Impacts of center pivot irrigation in the Columbia Basin were reviewed. As of 1976, over 225,000 acres were being irrigated by center pivot units in a five-county area of the basin in Oregon and Washington. Most of the development took place since 1970. Dynamic application of center pivot technology altered the concept of irrigability in the study area, converting lands that were often rolling, sandy, and plagued by wind erosion from low grade grazing to productive irrigated units. This development was entirely by private enterprise, with large corporate farms accounting for much of the effort. Little prior comprehensive planning or coordination took place. When the circulation of water is altered on such a massive scale, however, unplanned impacts may be far reaching. In this case they include: (1) acceleration of the shift to high cost thermoelectric generation, (2) alteration of state institutions designed to allocate water, and (3) possible significant alterations of the socioeconomic fabric of small rural service centers. (Skogerboe-Colorado State)
W79-05818

CONSERVATION AND CONVENTIONAL SYSTEMS FOR CONTINUOUS PRODUCTION OF CORN,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
D. C. Erbach, W. G. Lovely, and G. E. Ayres.
Paper No. 78-2517, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 9 p. 4 fig, 9 tab, 22 ref. ASAE, St. Joseph, Michigan.

Descriptors: Till, Soil management, Conservation, Crop production, Corn(Field), Economics, Weed control, Iowa.

Seven tillage systems were evaluated for continuous production of corn in Central Iowa on a soil from the Clarion-Nicollet-Webster Soil Association. Comparative weed control, stand establishment, surface plant residue, soil nutrient profile, yield, and economic results were discussed. (Skogerboe-Colorado State)
W79-05820

SIMAZINE RESIDUE LEVELS IN IRRIGATION WATER AFTER DITCHBANK APPLICATION FOR WEED CONTROL,
Science and Education Administration, Denver, CO. Aquatic Weed Control Research Lab.
For primary bibliographic entry see Field 5B.
W79-05821

REDOX POTENTIALS IN A CROPPED POTATO PROCESSING WASTE WATER DISPOSAL FIELD WITH A DEEP WATER TABLE,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 5B.
W79-05822

DETERMINATION OF OPTIMAL WELL CAPACITIES FOR CONTINUOUS IRRIGATION PROGRAMS,
Washington Univ., St. Louis, MO. Center for the Biology of Natural Systems.
A. K. Sanghi, D. Johnson, and G. Kuepper.
CBNS-AE-9, NSF/RA-78-0017, January, 1978. 50 p, 11 fig, 17 tab, 18 ref, 2 append, 11 equ.

Descriptors: *Irrigation programs, *Model studies, Wells, Evapotranspiration, Growth stages, Timing, Groundwater.

A method was developed to predict optimal and acceptable suboptimal well capacities using a model developed at the University of California, Davis. Net revenue values were calculated at various well capacities using a budget for a 132-acre field and an equation for determining yield reduction. The well capacities were chosen based on growth periods found to have a differential impact on corn yields. These differential effects were discussed in terms of the optimal and suboptimal well capacities that will fulfill water requirements through certain parts of the growth season. This model may provide a farmer with a predictive tool so that he may consider optimally timed water application by an optimal well capacity to maximize net revenue. In addition, it may provide information for policy makers to enact regulations, which would make the use of groundwater resources more beneficial to the society. (Skogerboe-Colorado State)
W79-05825

POTENTIAL FOR USING SALINE WASTE WATER FROM ELECTRICAL POWER PLANTS FOR IRRIGATION,
Utah State Univ., Logan. Dept. of Soils and Biometeorology.
For primary bibliographic entry see Field 3C.
W79-05829

SPRINKLER NOZZLE,
R. H. Keely.
U.S. Patent No. 4,132,358, 6 p, 5 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 1, p 145, January 2, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Application equipment, Nozzles, Irrigation practices, Irrigation efficiency.

A pop-up nozzle for an underground sprinkler system includes a spray head fastened to the top of a hollow stem which is slidably mounted within a cylincrical sleeve. The sleeve is imbedded in the ground, and its lower end is connected to a source of pressurized water. As water flows into the sleeve, the stem and spray move axially within the sleeve so that the spray head projects above ground level and allows water emanating from the spray head to clear ground obstructions. A radial projection on the stem mates with one of several circumferentially spaced axial grooves in the sleeve to fix the angular position of the spray in a predetermined direction when a unidirectional spray head is used. (Sinha-OEIS)
W79-05952

CASING MOUNTED EMITTER,
Harmony Emitter Co., Inc., Tucson, AZ. (Assignee).
R. C. Harmony.
U.S. Patent No. 4,132,364, 8 p, 8 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 1, p 147-148, January 2, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Flow control, Emitters.

A casing mounted miniaturized emitter is described which discharges water under high pressure at a constant rate despite variations in water pressure. The emitter is self purging during initiation and cessation of water flow through it. The high pressure emitter will pass fluid suspension particulate matter and will convey water from the conduit to a distant location at a constant flow rate despite pressure variations within the conduit. A pair of spaced apart annular flanges define an annular channel in the orifice in the wall of the conduit. An insert has a pair of downwardly depending flexible skirts with striae on facing surfaces of the skirts and is supported by the casing. The pair of skirts regulates the size of the passageway through the emitter to maintain a constant rate of flow. (Sinha-OEIS)
W79-05953

DRIVE MEANS FOR IRRIGATION SYSTEM,
Wade (R.M.) Co., Portland, OR. (Assignee).
L. C. Olson, and G. Cornelius.
U.S. Patent No. 4,132,244, 8 p, 6 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 1, p 105, January 2, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Application equipment, Distribution systems, Irrigation efficiency.

An irrigation system includes an irrigation line mounted on wheels. The wheels may be easily and conveniently moved from respective positions perpendicular to the irrigation line to respective positions parallel to the irrigation line to allow for towing of the irrigation line as desired. Movement of the wheels provides for appropriate engagement and disengagement of gear means through which drive is provided to the wheels. (Sinha-OEIS)
W79-05954

DUAL-FUNCTION VALVE,
Irrigation Specialties Co., San Gabriel, CA. (Assignee).
C. A. Lieding.
U.S. Patent No. 4,131,235, 6 p, 6 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 4, p 1123, December 26, 1978.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Irrigation efficiency, Irrigation practices, Automatic control, Valves, Application equipment.

A dual-function valve assembly for an irrigation system is described which typically has sprinkler heads disposed at different elevations downstream from a control valve. A spring-loaded check valve prevents drainage of the sprinkler lines through the lower heads when the control valve is closed. A second valve in the assembly closes to prevent excessive flow if a sprinkler head is damaged or removed. The valve assembly is especially useful in unattended, automatically actuated irrigation systems. (Sinha-OEIS)
W79-05959

ADJUSTABLE BUBBLER SPRINKLER HEAD,
Nelson (L. R.) Corp., Peoria, IL. (Assignee).
J. R. Pescetto.
U.S. Patent No. 4,131,234, 7 p, 6 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 4, p 1123, December 26, 1978.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Irrigation efficiency, Irrigation practices, Flow control, Application equipment.

A sprinkler head comprising an annular sprinkler body of molded plastic has a tubular member of molded plastic snapped into operative fixed relation within the central portion. A flow adjusting screw is threaded within the tubular member and has its head in adjustable flow restricting relation to inlet passages in the sprinkler body. Water flowing through the controlled inlet passages moves upwardly along the interior of an annular wall, outwardly along an end wall of the adjusting member, downwardly between the exterior of the annular wall and the adjusting member and then radially outwardly. The axial position of the spray adjusting member determines the spray pattern which is variable from a thick umbrella sheet pattern to radially extending discrete streams. (Sinha-OEIS)
W79-05960

'CORNER PIVOT' AN EFFECTIVE CORNER WATERING SYSTEM,
Lindsay Mfg. Co., NE.
R. E. Callies.
Paper No. 78-2006, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 18 p. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Irrigated land, Irrigation efficiency, Irrigation systems, Distribution systems, Irrigation design.

The 'Corner Pivot' system incorporates the use of a long span single tower center pivot irrigation machine which is attached to and pivots about the outer most tower of a conventional center pivot irrigation machine. This attachment is used to extend the reach of the standard machine for the purpose of watering the corners or irregularly shaped areas along the perimeter of the field which could not normally be reached by a conventional center pivot machine. (Skogerboe-Colorado State)
W79-05990

MATHEMATICAL MODELS AND BORDER IRRIGATION DESIGN,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
D. D. Fangmeier, and T. Strelkoff.
Paper No. 78-2007, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 11 p. 11 fig, 4 tab, 6 ref, ASAE, St. Joseph, Michigan.

Descriptors: *Border irrigation, Irrigation design, *Mathematical models, Runoff, Design criteria, Infiltration rates, Recession curves, Time lag, Irrigation efficiency.

A mathematical model of flow in irrigation borders assuming zero inertia was used to evaluate U.S. Soil Conservation Service design criteria for sloping borders with runoff and to demonstrate model capabilities. Model results indicated that the Soil Conservation Service design criteria are reasonable. (Skogerboe-Colorado State)
W79-05991

BORDER-STRIP IRRIGATION DESIGN--PRACTICAL APPROACH FROM A THEORETICAL BASIS,
California Polytechnic State Univ., San Luis Obispo. Dept. of Agricultural Engineering.
J. L. Merriam.
Paper No. 78-2008, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 14 p, 14 fig, 1 tab, 2 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Irrigation design, *Border irrigation, Surface irrigation, Graphical methods, Recession curves, Flow rates, Irrigation efficiency, Moisture deficit, Time lag, Infiltration.

A graphical procedure was developed for designing border-strip irrigation systems. It is based on the principle that the shape of the recession curve is relatively unchanging for any specific field, and therefore, it is the controlling key condition for design or operation. Conditions modifiable by the designer or operator to obtain high efficiency are: (1) the stream size that controls the rate of advance; (2) the Management Allowed Deficiency of soil moisture at the time of irrigation; (3) the length of the strip; and (4) the distance down the strip at which flow is cut off. (Skogerboe-Colorado State)
W79-05992

RAPIDLY OBTAINING OPTIMAL IRRIGATION SYSTEM DESIGNS,
Idaho Univ., Aberdeen.
J. R. Busch, G. D. Galinato, C. E. Brockway, and G. E. Steinbach.
Paper No. 78-2009, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 16 p. 6 fig, 8 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Irrigation design, Irrigation systems, Optimization, *Computer programs, Computer models, Cost allocation, Costs, Dynamic programming, Linear programming.

A methodology was developed and tested that will allow irrigation planners to obtain optimal system designs. Computer routines were used to obtain costs of individual system components. The optimization procedures produce least cost designs subject to specified constraints and these constraints can easily be changed to allow rapid evaluation of alternatives. (Skogerboe-Colorado State)
W79-05993

COMPUTER MODEL FOR CENTER PIVOT SPRINKLER DESIGN,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
G. L. Kelso, and A. R. Jarrett.
Paper No. 78-2003, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 19 p, 12 fig, 6 tab, 7 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Computer models, *Computer programs, Irrigation systems, Flow rates, Uniformity coefficient, *Irrigation design.

A computer aided center pivot design program was presented. The program selected specific sprinklers and nozzles from input parameters of flow rate to the pivot, system length, sprinkler spacing and desirability of an endgun. The program also computed a uniformity coefficient for the system based on the sprinklers and nozzles selected. (Skogerboe-Colorado State)
W79-05994

THE USE OF COMPUTERS TO NOZZLE CENTER PIVOT SYSTEMS,
Toro Co., Riverside, CA.
R. M. Morgan.
Paper No. 78-2002, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 8 p. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Distribution patterns, *Computer programs, Distribution, Nozzles, Irrigation systems, Irrigation design.

The practice of irrigation by sprinkler head distribution on center pivot machines has been a system of application crops for nearly twenty years. Many types of heads and spacings have been used with a goal toward achieving more even distribution. The art of computer-use to predetermine distribution uniformity was discussed. (Skogerboe-Colorado State)
W79-05995

DETERMINING CENTER-PIVOT SPRINKLER UNIFORMITIES,
Department of Agriculture, Lethbridge (Alberta).
L. Ring, and D. F. Heermann.
Paper No. 78-2001, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah. 18 p, 3 fig, 6 tab, 12 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Uniformity coefficient, Irrigation efficiency, Distribution patterns, *Irrigation design.

Catch can evaluations were conducted and the water application and uniformity were calculated for different can spacings and number of rows. Results were compared to each other and to a theoretical application pattern. A recommended procedure for the field evaluation of center-pivot systems was suggested. (Skogerboe-Colorado State)
W79-05996

PERFORMANCE OF CENTER-PIVOT SPRINKLER IRRIGATION SYSTEMS OPERATING AT REDUCED PRESSURES,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
S. M. Arshad Ali, and A. D. Barefoot.
Paper No 78-2005, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 19 p. 4 fig, 4 tab, 14 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sprinkler irrigation, Irrigation systems, Performance, Water pressure, Low flow, Uniformity coefficient, Distribution patterns, Evaporation, Irrigation efficiency.

Spray distribution obtained from a single stationary sprinkler head was utilized to determine the effects of reduced operating pressure on evaporation loss, uniformity of application, sprinkler spacing, and application rate of a center-pivot sprinkler irrigation system. Results indicated that at reduced pressure, the sprinkler performances were satisfactory. (Skogerboe-Colorado State)
W79-05997

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

RIVER RUNOFF REGULATION AND WATER-MANAGEMENT CALCULATIONS, (METODIKA REGULIROVANIYA STOKA I VODOKHOZYAISTVENNYKH RASCHETOV),
P. A. Lyapichev.
Available from the National Technical Information Service, Springfield, VA 22161 as TT74-50022, Price codes: A14 in paper copy, A01 in microfiche. TT74-50022, National Technical Information Service, Springfield, VA., 1975. 302 p, 153 fig, 15 tab, 59 ref.

Descriptors: *Rivers, *Runoff, *Regulation, *Water management(Applied), Reservoirs, Planning, Design, Water users, Annual, Precipitation(Atmospheric), Seasonal, Electric power, Powerplants, Hydroelectric plants, Statistical methods, Graphical methods, Inflow, Water quality, Discharge(Water), Foreign countries, Foreign research, Methodology, Analytical techniques, *USSR, Runoff regulation problems.

Efficient utilization of water resources is one of the major current problems of the USSR economy. Many rivers have begun to be utilized comprehensively in various major projects only during the last 10 years, mostly through runoff regulation. Runoff regulation has become an indispensable and generally accepted means of efficient utilization of rivers. Soviet scientists and engineers have solved many complex and crucial problems of runoff regulation and water-management calculation and have designed numerous hydraulic installations. In the author's opinion, detailed calendrical regime graphs and methods for their preparation are fundamental; whereas statistical methods are auxiliary, although he applies them even to complex regulation forms to which they were never previously applied. Broad subject areas presented included: (1) river runoff, water reservoirs, and general problems of runoff regulation; (2) annual runoff regulation; and (3) long-term regulation of runoff with constant and variable guaranteed outputs. (Froehlich-ISWS)
W79-05544

GEOHYDROLOGICAL RESEARCH AT THE CHALMERS UNIVERSITY OF TECHNOLOGY, GOTEBORG.
For primary bibliographic entry see Field 4C.
W79-05546

LOCAL INFILTRATION OF STORM WATER,
Royal Inst. of Tech., Stockholm (Sweden).
K. Cederwall, and O. Holmstrand.
In: Geohydrological Research at the Chalmers University of Technology, Goteborg; Papers Presented at the Nordic Hydrological Conference in Reykjavik, August 29 to September 1, 1976, p 33-41, May 1977. 3 fig, 4 ref.

Descriptors: *Storm runoff, *Cities, *Urban hydrology, *Infiltration, Percolation, Recharge, Pit recharge, Groundwater, Soil water, Soil water movement, Runoff, Storm water, Storms, Foreign countries, Foreign research, Urbanization, Drainage, Hydrology, Hydrogeology, *Bratthammar(Sweden), *Goteborg(Sweden), *Halmstad(Sweden), *Percolation basins, *Sweden.

The purpose of the present research project was to analyze the hydrological and geohydrological conditions for local infiltration of storm water. This means determination of the impact on runoff in urban areas due to percolation basins and, as a consequence of this, determination of if and to what extent the dimensions of storm water pipes can be reduced. Furthermore, the purpose was to study geohydrological conditions for percolation basins with respect to infiltration of storm water and to see to what extent soil water and groundwater conditions may be affected. An essential part of the research work was studies on field installations of percolation basins in Bratthammar, Goteborg, and Halmstad. (See also W79-05546) (Sims-ISWS)
W79-05550

WATER-SUPPLY POTENTIAL OF THE LOWER HILLSBOROUGH RIVER, FLORIDA, 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. L. Goetz, R. C. Reichenbaugh, and J. K. Ogle.
Geological Survey Water-Resources Investigations 78-29 (open-file report), 1978. 25 p, 6 fig, 1 plate, 6 tab, 11 ref.

Descriptors: *Water supply, *Reservoirs, *Reservoir storage, *Water quality standards, Data collections, Effluents, Water analysis, Streamflow, Inflow, Low flow, Channel morphology, Available water, Projections, *Florida, *Tampa Reservoir, *Lower Hillsborough River(FL).

The Tampa Reservoir Dam, constructed in 1945 on the lower Hillsborough River 10 miles above the mouth, provides 12.5 miles of natural channel storage for city water supply. Flow of the lower Hillsborough River and storage in Tampa Reservoir become deficient during annual dry periods. Excluding dead storage, Tampa Reservoir capacity is 2,000 million gallons at a maximum stage of 22.5 feet above mean sea level. For 20-year, annual-minimum-flow conditions, Hillsborough River flow is exceeded when the draft rate reaches 38 million gallons per day. In any year, at full capacity, Tampa Reservoir and Hillsborough River have a 5-percent chance of failing to supply at least 66 million gallons of water per day; and a 2-percent chance of failing to supply at least 59 million gallons per day. Runoff and effluent from agricultural, industrial, and urban areas enter the stream system above Tampa Reservoir. A wide range of chemical constituents, including nutrients, metals, herbicides, and pesticides analyzed in samples taken at the reservoir, are all below the maximum acceptable limits set by the U.S. Environmental Protection Agency for raw waters used for public supply. Water color exceeds the recommended level based on aesthetic considerations. The color is successfully removed through the treatment process at the Tampa water treatment plant. (Woodard-USGS)
W79-05586

SPECIAL FLOOD HAZARD INFORMATION: TURKEY CREEK, BRYAN, TEXAS.
For primary bibliographic entry see Field 2E.
W79-05716

FLOOD PLAIN INFORMATION: MAXWELL CREEK, PARKER, TEXAS,
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W79-05719

FLOOD PLAIN INFORMATION: DEER CREEK AND TRIBUTARIES, CROWLEY, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W79-05720

STORM WATER MANAGEMENT FOR LITTLE LEHIGH AND CEDAR CREEK DRAINAGE BASINS,
Lehigh Univ., Bethlehem, PA.
R. L. Johnson, P. J. Usinowicz, and R. D. Reardon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 598, Price codes: A05 in paper copy, A01 in microfiche. Prepared for U. S. Depart. of Housing and Urban Development, Washington, D.C., December, 1976. 96 p, 4 append, 9 tab, 18 fig, 68 ref.

Descriptors: *Water quality, *Water pollution control, *Water quality control, *Storm runoff, *Storm water management, *Models, *Allentown(PA), *Cedar Creek(PA), *Little Lehigh Creek(PA), *Stormwater management model(SWMM), Water resources, Rainfall, Model studies, Simulated rainfall, Heavy metals, Biochemical oxygen demand, Nitrates, Coliform bacteria, Urban planning, Stream water quality, Infiltration.

This report addresses the environmental problems of urban storm water runoff in the Allentown, PA area. The study utilized extensive field surveys and water quality data to develop a first level calibration of the Storm Water Management Model

(SWMM) for the Little Lehigh and Cedar Creek drainage basins, using the College Heights Boulevard drainage system. The SWMM is separated into four computational blocks: Runoff, Transport, Storage/Treatment, and Receiving. The blocks model the rainfall and runoff, the piping network, various storage and/or treatment alternatives, and the storm water effect on the receiving water. The report discusses measurement techniques of water quality, rainfall, runoff, and storm flow. The appendices contain the results of all the stream and stormwater runoff water quality analyses, including each parameter, date and time of sample, the level of parameter for each sampling station, the development of a 10-year 3-hour design storm event, and observed rain data. Storm runoff water quality can be as poor or worse than raw sewage. This will have grave effects if the receiving body is also used as a public water supply. Many impervious areas of this drainage basin discharge storm runoff onto lawns and other pervious areas other than into the drainage system; this practice should be encouraged in new development areas. It is recommended that the City of Allentown address the problem of roof drains, driveways and other impervious surfaces and establish a policy of where this stormwater runoff should go so that planning and engineering personnel can properly design and evaluate the impacts of urban development. (Coan-NC)
W79-05721

A PHOSPHORUS BUDGET FOR LAKE BURLEY GRIFFIN AND MANAGEMENT IMPLICATIONS FOR URBAN LAKES,
For primary bibliographic entry see Field 5C.
W79-05734

BIOLOGICAL EFFECTS OF RICE-FIELD HERBICIDE MACHETE ON VARIOUS STRAINS OF THE NITROGE-FIXING BLUE-GREEN ALGA NOSTOC MUSCORUM,
Banaras Hindu Univ., Varanasi (India). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W79-05744

EFFECTS OF DRAINAGE PROJECTS ON RUNOFF FROM DEPRESSIONAL WATERSHEDS,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
I. D. Moore, and C. L. Larson.
Paper No. 78-2504, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 5 p. ASAE, St. Joseph, Michigan.

Descriptors: Drainage effects, Drainage practices, Surface drainage, Subsurface drainage, Surface runoff, Subsurface runoff, Peak discharge, Small watersheds, Mathematical models, Statistical methods.

Runoff from watersheds characterized by numerous depressions was studied statistically and by use of a special purpose watershed model. Application of the model to two small watersheds indicated that drainage development increases annual runoff, storm runoff and peak discharges. (Skogerboe-Colorado State)
W79-05979

SEDIMENT MANAGEMENT CONCEPTS IN URBAN STORM WATER SYSTEM DESIGN,
Geological Survey, Reston, VA. Water Resources Div.
H. P. Guy.
In: Urban Storm Drainage: Proceedings of the International Conference held at the University of Southampton, England, p 523-535, 1978. 3 fig, 1 tab, 20 ref.

Descriptors: *Sediment transport, *Urbanization, *Storm runoff, *Sediment control, Methodology, Detention reservoirs, Drainage programs, Planning, Drainage systems, Water pollution control, Evaluation.

Storm drainage systems can be designed which will greatly reduce peak rates of runoff and the amount of sediment and pollutants normally transported from urbanization to receiving water bodies. Reduction in peak flow rates reduces the potential for serious channel enlargement and additional sediment problems downstream from the development. Optimum design can be achieved through land-use planning that is well coordinated with natural drainage. This will make it possible to minimize excavation and soil exposure during construction, and provide a maximum of individual and (or) community onsite storm water detention storage. The resulting storm drainage system would usually have a lower initial cost and result in a more esthetically pleasing neighborhood than generally exists with conventional designs. (Woodard-USGS)
W79-05981

4B. Groundwater Management

LOCAL INFILTRATION OF STORM WATER,
Royal Inst. of Tech., Stockholm (Sweden).
For primary bibliographic entry see Field 4A.
W79-05550

INJECTION OF WATER INTO WELLS FOR INVESTIGATION OF LIMITED AQUIFER,
Chalmers Univ. of Technology, Goteborg (Sweden).
L. Carlsson, and B. Kozerski.
In: Geohydrological Research at the Chalmers University of Technology, Goteborg; Papers Presented at the Nordic Hydrological Conference in Reykjavik, August 29 to September 1, 1976, p 55-66, May 1977. 13 fig, 7 ref.

Descriptors: *Injection wells, *Potentiometric level, *Groundwater, Aquifers, Bedrocks, Piezometry, Recharge, Recharge wells, On-site investigations, Construction, Tunnels, Foreign research, Storage, Storage coefficient, Transmissivity, Geology, Hydrogeology, *Sweden.

Due to leakage in underground constructions in bedrock, decreasing piezometric head has been observed in confined aquifers in clay-filled areas in the region of Goteborg, Sweden. Water-injection tests were performed in an area with a very limited aquifer in order to prevent this decreasing. By analyzing both the injection- and the recovery-curves, it was possible to localize the leakage-point for the aquifer and the hydrogeological properties of the aquifer. (See also W79-05546) (Sims-ISWS)
W79-05552

GROUNDWATER PROJECTIONS FOR 11 BASINS,
Arizona Water Resources Research Center, Tucson.
Arizona Water Resources News Bulletin, News Bulletin 78-3, 4 p, May-June 1978. 1 fig.

Descriptors: *Groundwater resources, *Arizona, *Groundwater availability, *Groundwater basins, Water supply, Groundwater recharge, Water management(Applied), Project planning, Planning, Administrative agencies, Evaluation, Forecasting, Estimating, Arizona Water Commission, Legal aspects, Hydrologic data.

Reported here is a synopses of the findings of the Arizona Water Commission's study on the impact of future growth on groundwater resources in 11 of the state's major basin areas. Utilizing the Department of Economic Securities population and economic growth projections and assuming no change in existing law and institutions as they relate to water and its use, the Commission reported its finding to the Groundwater Management Study Commission to aid in its task of recommending and preparing legislation for the best development, utilization and conservation of the state's groundwater. The 11 basins studied account for about 80% of the state's water depletion and include: Avra Valley, Douglas, Harquahala Plains, Little Chino Valley, Lower Santa Cruz, Safford, Salt River, Upper San Pedro, Upper Santa Cruz, Willcox and Yuma. For each of the basins analyzed, information is supplied on pumping depths and costs, overdrafts, urban-agricultural-mining demands, Indian water rights, irrigation, diversions, and other water management considerations. The intention of this study was to provide an informational base upon which to evaluate potential groundwater management strategies and aid Commission members in meeting their responsibilities of informing interested persons of potential groundwater problems and solutions. (Tickes-Arizona)
W79-05554

GROUND-WATER LEVELS AND QUALITY DATA FOR GEORGIA, 1977,
Geological Survey, Doraville, GA. Water Resources Div.
Geological Survey open-file report 79-213, October 1978. 88 p, 5 ref.

Descriptors: *Groundwater resources, *Water levels, *Observation wells, *Georgia, *Water quality, Aquifers, Withdrawal, Water supply, Groundwater recharge, Hydrogeology, Hydrologic data, Water level fluctuations, Hydrographs, Well data, Water utilization, Groundwater availability, Annual report.

This report begins a publication format that will present annually both water-level and water-quality data in Georgia. In this format the information is presented in two-page units: the left page includes text which summarizes the information for an area or subject and the right page consists of one or more illustrations. Daily mean water-level fluctuations and trends are shown in hydrographs for the previous year and fluctuations for the monthly mean water level the previous 10 years for selected observation wells. The well data best illustrate the effects of changes in recharge and discharge in the various ground-water reservoirs in the State. A short narrative explains fluctuations and trends in each hydrograph. (Woodard-USGS)
W79-05607

EFFLUENT IRRIGATION OF COASTAL BERMUDA GRASS,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3C.
W79-05624

EVALUATION OF GROUNDWATER FLOW AND RECHARGE THROUGH GLACIAL DRIFT, MICHIGAN STATE WATER QUALITY MANAGEMENT PROJECT, EAST LANSING, MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Geology.
G. L. Larson, and J. Lovato.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 538, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report, April, 1979. 59 p. OWRT A-095-MICH(1). 14-31-0001-7048, 14-34-0001-8024.

Descriptors: *Groundwater recharge, Glacial drift, Glacial sediments, Infiltration, Michigan, Saginaw formation.

A geohydrologic study of glacial sediments underlying the spray irrigation site of the Michigan State University Water Quality Management Project demonstrates that the site is underlain by both clay till deposits and interbedded gravel layers. Aquifer testing of the drift material indicates that the average transmissivity of the gravel units is approximately 4000 gpd/ft (50 cu m/d m), while the vertical permeability of the clay units averages 0.12 gpd/sq ft (5.7 x .001 cm/sec). Observed infiltration rates (0.07 gpd/sq ft) at the site appear to be twice the rate (0.03 gpd/sq ft) calculated from the aquifer test data. The difference in the infiltration rates is primarily attributed to downward flow of water along the permeable gravel layers, which

are, to some degree, hydraulically connected to the underlying Saginaw Formation. Analysis of lithologic and water level data from numerous observation wells located on the research site also suggests that maximum recharge potential to the Saginaw Formation exists along the northwestern edge of the site where MSU production well drawdown is greatest and where the drift material is coarsest. W79-05791

DETERMINATION OF OPTIMAL WELL CAPACITIES FOR CONTINUOUS IRRIGATION PROGRAMS,
Washington Univ., St. Louis, MO. Center for the Biology of Natural Systems.
For primary bibliographic entry see Field 3F.
W79-05825

4C. Effects On Water Of Man's Non-Water Activities

GEOHYDROLOGICAL RESEARCH AT THE CHALMERS UNIVERSITY OF TECHNOLOGY, GOTEBORG.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 054, Price codes: A04 in paper copy, A01 in microfiche. Document D17:1977, Papers presented at the Nordic Hydrological Conference in Reykjavik, August 29-September 1, 1976. Chalmers University of Technology, Goteborg (Sweden), May 1977. 73 p. Gilbert Svensson, Editor.

Descriptors: *Storm runoff, *Groundwater, *Cities, Urbanization, Runoff, Infiltration, Permeability, Transmissivity, Water quality, Wells, Injection wells, Analytical techniques, Model studies, Mathematical models, On-site investigations, Geology, Hydrology, Hydrogeology, *Sweden.

The 6 papers in this document originally were presented at 'the Nordic Hydrological Conference' in Reykjavik, August 29-September 1, 1976. The research reported in these papers was carried out within the Urban Geohydrology Research Group at the Chalmers University of Technology. The main fields of research for this group are storm water, quantity and quality, and groundwater behavior, especially in urban areas. At the back of this document there was a list of publications published by the Urban Geohydrology Research Group. (See W79-05547 thru W79-05552) (Sims-ISWS)
W79-05546

SWEDISH URBAN HYDROLOGICAL RESEARCH: A REVIEW,
Chalmers Univ. of Technology, Goteborg (Sweden).
L. Carlsson, and G. Svensson.
In: Geohydrological Research at the Chalmers University of Technology, Goteborg; Papers Presented at the Nordic Hydrological Conference in Reykjavik August 29 to September 1, 1976, p 1-13, May 1977. 2 fig, 4 ref.

Descriptors: *Urbanization, *Water resources, *Groundwater, *Research and development, Cities, Planning, Drainage, Water levels, Water balance, Runoff, Foreign research, Infiltration, Buildings, Subsidence, Land subsidence, Waste water(Pollution), Storm runoff, Sewers, Urban hydrology, *Sweden.

The process of urbanization and modern construction methods cause disturbances to groundwater conditions. Sinking groundwater levels, caused by increased drainage in combination with diminished percolation and infiltration, can result in severe damages both on ground surfaces and to buildings. Construction, combined with the exploitation of new land area, has been the dominating factor in Swedish urbanization. Maintenance and restoration of old sewer systems and new alternatives for managing storm water are branches which will be of immediate interest in future research activities concerning water and problems in connection with water. An increased number of houses outside urban areas makes new demands on the construction of water and sewage facilities. In addition to this, there are increased demands on the quality of water from urban areas which is let out in recipients. This implies a need for treatment of water before the outlet or measures to change both amount and quality of water in the long run. (See also W79-05546) (Sims-ISWS)
W79-05547

SOME RESULTS FROM URBAN RUNOFF STUDIES IN BERGSJON GOTEBORG,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Hydraulics.
For primary bibliographic entry see Field 2A.
W79-05548

LOCAL INFILTRATION OF STORM WATER,
Royal Inst. of Tech., Stockholm (Sweden).
For primary bibliographic entry see Field 4A.
W79-05550

FIN ROT DISEASE STUDIES IN THE NEW YORK BIGHT,
National Marine Fisheries Service, Oxford, MD. Middle Atlantic Coastal Fisheries Center.
For primary bibliographic entry see Field 5C.
W79-05702

STORM WATER MANAGEMENT FOR LITTLE LEHIGH AND CEDAR CREEK DRAINAGE BASINS,
Lehigh Univ., Bethlehem, PA.
For primary bibliographic entry see Field 4A.
W79-05721

IMPACTS OF RECREATION ON RIPARIAN SOILS AND VEGETATION,
Vermont Univ., Burlington. School of Natural Resources.
R. E. Manning.
Water Resources Bulletin, Vol. 15, No. 1, p 30-43, February 1979. 4 fig, 70 ref.

Descriptors: *Recreation, *Environmental effects, *Reviews, *Riparian land, Vegetation effects, Hydrologic aspects, Infiltration, Runoff, Soil erosion, Soil compaction, Management, Riparian plants, Water resources, Recreation facilities, Camping, Natural resources, Soil impact cycle, Riparian soils.

The seemingly magnetic attraction of water resources for recreation has direct implications for proximate land resources which are needed to provide access and support facilities. This paper reviewed and synthesized the literature dealing with the impacts of recreation use on riparian soils and vegetation. Part one of the paper sets forth the major negative impacts of recreation use on soils and vegetation. A 7-step soil impact cycle was identified, beginning with the scuffing away of leaf litter and other organic material and working through the soil erosion and sedimentation process. Four major kinds of impacts of recreation use on vegetation were outlined, and the 'vicious circle' relationship between impacts on soil and vegetation was demonstrated through a Soil/Vegetation Impact Diagram. Part two identified several spatial and temporal patterns of environmental impact caused by recreation use. The node and linkage pattern of recreation use, campground and trail expansion, ground cover response and succession, rates of soil compaction, and resource response to various intensities of recreation use are important aspects. The final part of the paper dealt with measuring environmental impacts caused by recreation use. Management implications of the research findings were considered throughout the paper. (Humphreys-ISWS)
W79-05843

WATER AND ENERGY IN THE WESTERN COAL LANDS,
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 6D.
W79-05845

EFFECTS OF LAND USE AND WATER MANAGEMENT ON WATER QUALITY IN THE WESTERN SOUTH NEW RIVER CANAL BASIN, SOUTHEAST FLORIDA, 1974-75,
Geological Survey, Tallahassee, FL. Water Resources Div.
B. G. Waller.
Geological Survey Water-Resources Investigations 78-30, March 1978. 56 p, 29 fig, 3 tab, 15 ref.

Descriptors: *Water pollution effects, *Water quality, *Land use, *Florida, *Canals, Surface waters, Groundwater, Flow profiles, Runoff, Watersheds(Basins), Path of pollutants, Salinity, Phosphates, Nitrates, Calcium compounds, Trace elements, Insecticides, Dissolved oxygen, Watershed management, *Broward County.

The South New River Canal (C-11) basin between water-control structures S-9 and S-13 is an area that is primarily undeveloped and the system of waterways within the basin is highly controlled for water-management purposes. Most of the recharge to the canals is by induced ground-water inflow and seepage. The chemical character of the surface and ground waters in inundated areas is mixed calcium-bicarbonate and sodium-chloride type. Inorganic nitrogen concentrations in surface waters are slightly higher in developed areas than in undeveloped areas. Concentrations of inorganic nitrogen in ground water in drained areas are 2-4 times greater than in undeveloped inundated areas. Average orthophosphate concentrations are uniformly low (0.01 to 0.03 milligrams per liter) throughout the basin. Total residue concentrations are fairly uniform throughout the basin and fluctuate primarily in response to hydrologic conditions. Runoff and load-discharge indices indicated that the loads of inorganic nitrogen, total residue, and phosphorus, and the discharge per unit of land drained were uniform throughout most of the basin. (Woodard-USGS)
W79-05978

4D. Watershed Protection

WATERSHED INVENTORY STUDIES OF GUADALUPE MOUNTAINS NATIONAL PARK, TEXAS,
Texas Tech Univ., Lubbock. Dept. of Park Administration and Landscape Architecture.
P. A. Fuller, and E. B. Fish.
Journal of the Arizona-Nevada Academy of Science, Vol. 13, No. 2, p 39-43, June, 1978. 3 fig, 3 tab, 20 ref. OWRT B-206-TEX(1).

Descriptors: *Census, *On-site data collection, *Future planning(Projected), *Drainage effects, *Watersheds(Basins), *Analytical techniques, *Watershed management, *Environmental effects, *Ecosystems, Geological surveys, Ecological distribution, Environmental control, Biological communities, Sampling, Ecotypes, Planning, National parks, Drainage density, Soil-water-plant relationships, Drainage patterns(Geologic), Surveys, Hydrologic data, Aerial photography, Vegetation, Channel morphology.

The Guadalupe Mountains National Park in Texas, established in 1966 and covering 77,500 acres, lies in a unique ecosystem in which many animal and plant species reach their northern, southern, eastern and western-most boundaries. To insure protection of the environmental factors contributing to this unique ecosystem, a study was initiated as a basic biological inventory to provide input data upon which planning and management efforts could be directed. Initial bio-physical and cultural resource inventories have indicated the critical importance of water in this semi-arid region and have highlighted the influential basis upon which this resource must be treated. Accordingly, major drainage basins which headwater within the park were delineated and characterized in terms of areal extent, shape perimeter length, drainage density,

drainage pattern, stream order, channel profile, topography, geologic parent material, and vegetative cover. The resultant data were used to compare the various watersheds in an effort to evaluate similarities among the individual basins. Thirty-five distinct basins were initially compared from which 6 groups of watersheds were established based upon highly similar basin characteristics. A 'landscape unit approach' involving aerial photographic interpretation techniques to provide a similar grouping of watersheds was performed and was in good agreement with results obtained from the traditional data index. (Tickes-Arizona)
W79-05610

EROSION CONTROL/SEDIMENT MODELING--SOUTHERN IDAHO A PROGRESS REPORT,
Idaho Agricultural Experiment Station, Aberdeen.
For primary bibliographic entry see Field 2J.
W79-05804

SURFACE WATER QUALITY ASSOCIATED WITH THE SURFACE MINING OF IOWA COAL,
Iowa State Univ., Ames. Energy and Mineral Resources Research Inst.
For primary bibliographic entry see Field 5B.
W79-05834

IMPACTS OF RECREATION ON RIPARIAN SOILS AND VEGETATION,
Vermont Univ., Burlington. School of Natural Resources.
For primary bibliographic entry see Field 4C.
W79-05843

THE SUSPENDED SEDIMENT REGIME OF AN OREGON COAST RANGE STREAM,
Pacific Northwest Forest and Range Experiment Station, College, AK. Alaska Region.
For primary bibliographic entry see Field 2J.
W79-05846

SEDIMENT MANAGEMENT CONCEPTS IN URBAN STORM WATER SYSTEM DESIGN,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W79-05981

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

NATIONAL URANIUM RESOURCE EVALUATION PROGRAM (NURE), HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE IN THE EASTERN UNITED STATES,
Du Pont de Nemours (E. I.) and Co., Aiken, SC. Savannah River Lab.
R. B. Ferguson, and V. Price, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as DP-MS-75-114, Price codes: A03 in paper copy, A01 in microfiche. Report DP-MS-75-114, April 1976. 26 p, 10 fig, 3 tab, 10 ref. ERDA AT(07-2)-1.

Descriptors: *Water chemistry, *Appalachian Mountain Region, *Sediments, *Uranium, *United States, *Sampling, Data collections, On-site data collections, On-site investigations, Chemical analysis, Suspended solids, Streams, Projects, Spectroscopy, Groundwater, Chemicals, Analysis, Surveys, Water quality, *Blue Ridge Mountains, Energy Research and Development Administration.

A geochemical reconnaissance of 25 eastern states for uranium will be conducted by the Savannah River Laboratory for the Energy Research and Development Administration. A sound technical basis for the reconnaissance is being developed by intensive studies of sampling, analysis, and data management. Results of 3 orientation studies in the southern Appalachian Piedmont and Blue Ridge areas indicated that multi-element analysis of -100 mesh (less than 149 micrometers) stream sediments will provide adequate information for reconnaissance. Stream and groundwater samples also provide useful information, but they are not considered cost-effective for regional reconnaissance in the areas studied. (Sims-ISWS)
W79-05520

GROUNDWATER SAMPLING IN URANIUM RECONNAISSANCE,
Union Carbide Corp., Oak Ridge, TN. Nuclear Div.
T. R. Butz.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF 770314-13, Price codes: A02 in paper copy, A01 in microfiche. Report, March 1977. 5 p, 2 fig, 1 ref.

Descriptors: *Groundwater, *Uranium, *Water chemistry, *Sampling, Wells, Water wells, Springs, Data collections, On-site data collections, On-site investigations, Chemical analysis, Instrumentation, Water quality, Chemicals, Data processing.

The groundwater sampling program conducted by the Oak Ridge Gaseous Diffusion Plant (ORGDP) is based on the premise that groundwater geochemistry reflects the chemical composition of, and geochemical processes active in, the strata from which the sample is obtained. Potential uranium-bearing areas can be identified at virtually any scale, depending on sample spacing and availability of groundwater samples from the strata of interest. In south Texas, for example, work by the ORGDP has shown that groundwater exhibits zonation related to known mineralization for uranium, vanadium, arsenic, molybdenum, sulfate, selenium, barium, and conductivity. A degree of zonation for these elements is present at both the regional and local scale. Personnel of the Uranium Resource Evaluation Project of ORGDP collect samples in pilot surveys, as well as in 2 reconnaissance phases, with groundwater samples collected in each phase. Experience from 8 pilot surveys conducted throughout the ORGDP area of responsibility has shown that wells are the best source of groundwater, although, on occasion, springs are sampled as part of the program. (Sims-ISWS)
W79-05521

HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE OF THE NATIONAL URANIUM RESOURCE EVALUATION PROGRAM, OCTOBER-DECEMBER 1976,
Los Alamos Scientific Lab., NM.
P. L. Aamodt, J. M. Hansel, Jr., M. M. Minor, and R. J. Beckman.
Available from the National Technical Information Service, Springfield, VA 22161 as GJBX 20-77, Price codes: A03 in paper copy, A01 in microfiche. Report LA-6708-PR, February 1977. 27 p, 11 fig, 3 tab. ERDA W-7405-ENG-36.

Descriptors: *New Mexico, *Montana, *Colorado, *Wyoming, *Water chemistry, *Sediments, *Uranium, *Sampling, Instrumentation, Data collections, Chemical analysis, X-ray fluorescence, Spectroscopy, Chemicals, Surveys, Computer programs, Analytical techniques, Water quality, On-site investigations.

Field sampling in New Mexico was limited this quarter to the collection of water and/or sediment samples from 4,000 locations in two 20,000-sq km areas in the southeastern corner of the state. Approximately 1,100 locations were sampled in Montana and Colorado as parts of pilot studies in those states, and 100 locations were sampled by a commerical contractor in south-central Wyoming. Several thousand samples were inventoried and sent to the analytical laboratories for analysis. A major effort has gone into the preparation of reports for open filing next quarter, including reports on pilot and orientation studies, reconnaissance sampling, and topical subjects. Uranium analysis of waters by fluorometry continued at an average rate of 850 analyses per week throughout the quarter. Multi-element analysis capability using x-ray fluorescence and spectro-chemical methods continued to be improved to increase both sample throughput and analytical precision. Modifications to the reactor transport system have lowered the effective uranium detection limit for 40-ml water samples to 0.25 ppt. The pneumatic transfer system also has been expanded to allow rapid multi-element analyses of sediment samples. Not all of the detectors have been installed to complete this system, but they will be in the next few months. Sediment samples have been analyzed for uranium at an average rate of 1,000 per week during this quarter. Several new computer programs have been developed to improve both the management and statistical treatment of National Uranium Resource Evaluation-Hydrogeochemical and Stream Sediment Reconnaissance data. (Sims-ISWS)
W79-05522

NITRATES AND BACTERIAL DISTRIBUTION IN RURAL DOMESTIC WATER SUPPLIES,
Texas Univ. Health Science Center at Houston. School of Public Health.
For primary bibliographic entry see Field 5B.
W79-05524

SORPTION AND ACCUMULATION OF CADMIUM IN THE SEDIMENT OF THE TAMA RIVER,
Tokyo Univ. (Japan). Inst. of Industrial Science.
M. Suzuki, T. Yamada, T. Miyazaki, and K. Kawazoe.
Water Research, Vol. 13, No. 1, p 57-63, 1979. 8 fig, 3 tab, 8 ref.

Descriptors: *Sorption, *Cadmium, *Sediments, Pollutants, Heavy metals, Sampling, Chemical analysis, Data processing, Rivers, Water pollution, Zinc, Foreign countries, Foreign research, Copper, Adsorption, Organic matter, Laboratory tests, Correlation analysis, *Japan, *Tama River(Japan).

Cadmium contents in the water and the sediment samples collected from the Tama River and several branches were measured. Cadmium (above 0.005 mg/l) was detected in only 4 of the water samples, while the sediment samples showed cadmium content of 1.0-9.8 micro g/g dry sediment. Cadmium concentration in the sediments of the main stream was correlated against ignition loss of the samples, and it was found that 1 g of ignition loss (organic matter) corresponded to 35 micro g of cadmium. The batch adsorption experiment in the laboratory using an aqueous solution of cadmium for 14 sediment samples with a higher concentration of cadmium indicated that the amount adsorbed by the sediment is highly dependent on the ignition loss. The amount adsorbed on unit mass of ignition loss could be correlated by a Freundlich-type equilibrium relation. The adsorption rate measurement showed that the intraparticle diffusion coefficient of cadmium in the sediment was about 0.0000011 sq cm/s, which is of a reasonable order of magnitude assuming the pore diffusion mechanism inside the particle. The results suggested that suspended solid particles of high organic content in flowing water contribute significantly to the transport of cadmium along the river. (Sims-ISWS)
W79-05525

GEOLOGIC AND GEOPHYSICAL DATA FROM OSCEOLA NATIONAL FOREST, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. A. Miller.
Geological Survey open-file report 78-799, October 1978. 101 p, 1 fig, 2 tab, 2 ref.

Descriptors: *Lithologic logs, *Radioactive well logging, *Marine microorganisms, *Hydrogeology, *Stratigraphy, Sedimentary rocks, Geologic units, Phosphates, Mining, Environmental effects, Projections, *Florida, *Osceola National Forest(FL), Ocala Limestone, Hawthorn Formation, Post-miocene deposits.

Ten core holes were drilled as part of a hydrologic study of Osceola National Forest. This report describes the detailed lithology of the cores taken from test drilling, illustrates gamma-ray logs obtained from the test holes and from wells near the forest, and lists the microfauna obtained and identified from the cores. (Woodard-USGS)
W79-05605

GRANULAR MEDIA FILTRATION OF DREDGING EFFLUENTS,
Northwestern Univ. Evanston, IL. Dept. of Civil Engineering.
D. K. Atmatzidis, J. A. FitzPatrick, and R. J. Krizek.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW1, Proceedings Paper 14342, p 33-50, February 1979. 4 fig, 5 tab, 18 ref. DACW 39-74-C-0090.

Descriptors: *Dredging, *Effluents, *Filtration, Sands, Gravels, Granules, Spoil banks, Waste disposal, Filters, *Dredged material, Granular media filtration, Diked disposal area, Filter systems, Clay suspensions.

The consideration of a dredged material confinement facility as a solid-liquid separation system requires the use of filter systems for clarifying disposal area effluents. The following data were presented: (1) the types of tests that were performed; (2) the rationale for selecting the range of values for the parameters; (3) the methods and techniques for conducting the tests and collecting the data; and (4) an analysis and review of the results. Conclusions were reported regarding the characteristics and performance capabilities of sands or gravels and anthracites as media for nonmechanized, deep-bed, filtration systems. In general, sands and anthracites with effective grain smaller than 2.0 mm and 3.5 mm and larger than 0.4 mm and 0.8 mm, respectively, are strong candidates for use in disposal area filter systems. (Roberts-ISWS)
W79-05621

ACID PRECIPITATION IN THE NEW YORK METROPOLITAN AREA: ITS RELATIONSHIP TO METEOROLOGICAL FACTORS,
Interstate Sanitation Commission, New York.
For primary bibliographic entry see Field 2K.
W79-05626

SOURCES AND FATES OF AROMATIC COMPOUNDS IN URBAN STORMWATER RUNOFF,
Environmental Protection Agency, Edison, NJ. Surveillance and Analysis Div.
M. J. MacKenzie, and J. V. Hunter.
Environmental Science and Technology, Vol. 13, No. 2, p 179-183, February 1979. 5 fig, 2 tab, 13 ref. NSF ENV74-14810B.

Descriptors: *Aromatic compounds, *Oil, *Storm runoff, *Sediments, Chemicals, Chemical analysis, Chromatography, Sampling, Organic compounds, Pollutants, Water pollution, Water pollution sources, Path of pollutants, Analytical techniques, Dibenzothiophene, Crankcase oil.

Petroleum-derived aromatic hydrocarbons and associated sulfur compounds in urban stormwater runoff and Delaware River sediment samples were characterized using a gas chromatograph equipped with a flame ionization/sulfur specific flame photometric detector system. Total petroleum hydrocarbon concentrations were determined gravimetrically in stormwater emanating from a northern Philadelphian storm sewer. Comparison of hydrocarbon and sulfur fingerprints of the aromatic fractions of environmental samples to reference oils indicated that crankcase oil was the most likely source of aromatics in stormwater runoff. A weathering study on used crankcase oil showed a loss of diaromatics accounting for their absence in the environmental samples. A method of transport by which land-based oil enters the aquatic environment and receiving water sediments was proposed. Dibenzothiophene was identified in the environmental samples by retention time and mass spectrometry. Concentrations of dibenzothiophene in stormwater runoff ranged from 44.2 to 62.3 ng/L. (Sims-ISWS)
W79-05627

NITROGEN AND CHLORIDE MOVEMENT IN SMALL UPLAND PIEDMONT WATERSHEDS: I. NITRATE-NITROGEN AND CHLORIDE DISTRIBUTION IN SOIL PROFILES,
Southern Piedmont Conservation Research Center, Walkinsville, GA.
For primary bibliographic entry see Field 5B.
W79-05641

NITROGEN AND CHLORIDE MOVEMENT IN SMALL UPLAND PIEDMONT WATERSHEDS: II. NITROGEN AND CHLORIDE TRANSPORT IN RUNOFF,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 5B.
W79-05642

NITRATE MOVEMENT IN A CHILEAN AGRICULTURAL AREA IRRIGATED WITH UNTREATED SEWAGE WATER,
Chile Univ., Santiago. Dept. of Inorganic and Analytical Chemistry.
For primary bibliographic entry see Field 5B.
W79-05643

HEALTH HAZARDS FROM DRINKING-WATER.
World Health Organization, Copenhagen (Denmark). Regional Office for Europe.
Working Group Report, 26-30 September 1977. 13 p.

Descriptors: *Potable water, *Lead, *Nitrates, *Water pollution effects, *Public health, *Water quality standards, Poisons, Toxicity, Human diseases, Pollutants, Heavy metals, Metal pipes, Nitrites, Nitrosamines, World Health Organization, International cooperation, Water pollution control, Water supply.

The World Health Organization's working group on health hazards from drinking water (European Region) met in September 1977 to consider: (1) the concept of 'health hazard', (2) health effects from increased lead levels in water, and (3) health risks from nitrate concentrations in water. The working group, composed of medical and technical experts from 11 countries, recommended that for lead: (1) the upper limit in running water should be 0.05 mg/l; (2) when lead pipes are present, lead content should not exceed 0.05 mg/l in a sample taken at the tap after flushing, and levels frequently or notably exceeding 0.1 mg/l should be reduced; and (3) when lead is present, water from domestic water softeners and hot-water systems should not be drunk. For nitrate: (1) nitrate NO3 level below 50 mg/l is acceptable for the general population, 50-100 mg/l is borderline, and over 100 mg/l is unacceptable; and (2) for infants under six months of age nitrate levels over 50 mg/l are unacceptable. It was agreed that setting of standards must take into account both analytical limits and technical feasibility. Criteria documents should consist of: (1) summary of issues and research priorities, (2) findings on which health risk evaluation is made, (3) evaluation of health hazard of the agent in question, and (4) appraisal of the significance of the health effect, with an indication of the basis for required safety factors. (Lynch-Wisconsin)
W79-05726

INFLUENCE OF NON-POINT POLLUTION SOURCES IN CONNECTION WITH THE TUY RIVER BASIN SANITATION STUDIES,
Universidad Central de Venezuela, Caracas.
J. R. Hurtado, and G. R. Mijares.
Progress in Water Technology, Vol 10, No 3-4, p 109-118, 1978. 3 fig, 9 tab, 2 ref.

Descriptors: *Tuy River Basin(Venezuela), *Nonpoint pollution, *Agricultural runoff, *Soil erosion, *Sewage disposal, *Water pollution sources, *Water treatment, Venezuela, Caracas(Venezuela), Rivers, River basins, Water pollution effects, Coliforms, Biochemical oxygen demand, Land use, Farm management, Water management, Water pollution control, Water quality standards, Streamflow, Dissolved solids, Seasonal, Planning, Point pollution.

Water pollution was studied in the Tuy River Basin of north-central Venezuela, an important source of water for the Caracas metropolitan area, to: (1) identify and measure water pollution sources from El Consejo to Pumping Station No. 1, (2) determine effects of pollution on water quality, (3) establish criteria for water at Pumping Station No. 1, and (4) determine if treatment of point sources of pollution is sufficient to meet criteria for Pumping Station No. 1 and to provide a safe source of water for Caracas after conventional treatment. Conclusions: (1) the River Tuy carries a flow composed of river water and untreated sewage discharged by Caracas; (2) for a safe water supply point sources must be treated and nonpoint sources, major contributors of coliforms and BOD, must be treated or eliminated; (3) major coliform inputs occur during both wet and dry seasons, especially as a result of topsoil erosion from farmland; (4) significant sources of BOD exist all along the river during the wet season, likewise attributable to agricultural activities; and (5) in most cases, the only practical management option is prevention rather than cure, including land-use management in the case of nonpoint pollution control. To provide rational management of the water resources of the mid-Tuy Basin, a river authority should be established which would begin by developing a comprehensive plan for watershed management. (Lynch-Wisconsin)
W79-05740

SURFACE WATER QUALITY ASSOCIATED WITH THE SURFACE MINING OF IOWA COAL,
Iowa State Univ., Ames. Energy and Mineral Resources Research Inst.
For primary bibliographic entry see Field 5B.
W79-05834

PARAMETER ESTIMATION OF STREETER-PHELPS MODELS,
Politecnico di Milano, Milan (Italy).
For primary bibliographic entry see Field 5B.
W79-05841

MONITORING AREAWIDE RURAL WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
L. F. Bliven, F. J. Humenik, F. A. Koehler, and M. R. Overcash.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE1, Proceedings Paper 14343, p 101-112, February 1979. 1 fig, 4 tab, 10 ref, 2 append. EPA R803328.

Descriptors: *Water quality, *Agricultural watersheds, *Monitoring, *Sampling, Streams, Rivers, Water pollution, Water pollution sources, Statistical analysis, Chemical analysis, Runoff, Rainfall, Water yield, Watersheds(Basins), Water chemistry, Pollutants, Oxygen, Nitrogen compounds, Hydrology, Sampling techniques.

Stream water quality is usually measured by either grab or automated sampling schemes. Data obtained by these two methods at identical locations on rural watersheds demonstrated that sampling techniques themselves impacted measured water quality values. Point-in-time comparisons indicated that COD and TOC concentrations were lower grab than automated samples due to sample procurement and storage effects. A first sample effect also was demonstrated for COD, TOC, TP, and TKN concentrations by analysis of sequential samples obtained with automated samplers employing

a sample-flush operational mode. The areawide annual water yield estimate obtained by simple time stratified grab sampling was approximately equal to the historical average, but the precision of individual site estimates was low because the distributions of flow measurements at the sites were highly skewed. Therefore, the potential of daily rainfall predictions as a stratification method to provide increased annual water yield precision at a given sampling frequency or budget level was demonstrated. (Sims-ISWS)
W79-05842

THE OCCURRENCE OF ORGANOCHLORINE RESIDUES IN RAINWATER,
Freshwater Fisheries Lab., Pitlochry (Scotland).
D. E. Wells, and S. J. Johnstone.
Water, Air, and Soil Pollution, Vol. 9, No. 3, p 271-280, April 1978. 2 fig, 5 tab, 19 ref.

Descriptors: *Pollutant identification, *Water pollution sources, *Rain water, *Polychlorinated biphenyls, Air pollution, Sampling, Analytical techniques, Methodology, Laboratory tests, Pollutants, On-site investigations, DDT, Pesticide residues, Foreign research, DDE, Dieldrin, DDD, Aroclors, *United Kingdom, Organochlorine residues.

A method for the extraction of organochlorine (OC) residues from rainwater was developed using coated polyurethane foam. The efficiency of the extraction procedure was tested at low concentrations (sub-ng/l), and the effects of flow rate, pH, suspended particulates, and the volume of water analyzed were determined. The coated foam plugs were incorporated into 8 sampling units stationed along the eastern coastline of the United Kingdom to monitor the atmospheric deposition of organochlorines. The results obtained were used to predict the annual contribution of OCs from the British mainland deposited into the North Sea. There was a gradation from north to south in the atmospheric contribution of OCs to the North Sea from a westerly direction, and with the data available at present (1978), it was possible to arrive at an approximate estimate of the aerial input. The area of the North Sea is 575,000 sq km, and the mean annual input for the 4 groups of organochlorines analyzed is 1.91 tons for PCBs, 1.43 tons for total DDT, 2.08 tons for total-HCH, and 0.27 tons for dieldrin. (Humphreys-ISWS)
W79-05848

TRACE METAL TRANSPORT FROM MINING, MILLING, AND SMELTING WATERSHEDS,
Syracuse Univ., NY.
For primary bibliographic entry see Field 5B.
W79-05858

METABOLISM OF NITROPHENOLS IN FLOODED SOILS,
Central Rice Research Inst., Cuttack (India). Lab. of Soil Microbiology.
B. Sudhakar, and N. Sethunathan.
Journal of Environmental Quality, Vol. 7, No. 3, p 349-352, July-September, 1978. 4 tab, 12 ref.

Descriptors: Organophosphorus compounds, *Flooding, Nitrites, Isotope studies, *Parathion, *Hydrolysis.

Nitrophenols (p-,o-, and m-isomers and 2,4-dinitrophenol) disappeared fairly rapidly from flooded alluvial and organic matter-rich acid sulfate (pokkali) soils inoculated with parathion (O,O-diethyl O,p-nitrophenyl phosphorothioate)-enrichment cultures from the respective soils. Nitrate, one of the reported end-products of nitrophenol (O,O-dimethyl O,p-nitrophenyl phosphorothioate) metabolism, accumulated only in inoculated alluvial soil, irrespective of the type of nitrophenol added. In an isotope study, ring cleavage of p-nitrophenol leading to carbon dioxide was demonstrated in flooded soils inoculated with parathion-enrichment culture, particularly under stirred conditions. Nitrophenols decomposed also in uninoculated samples of both soil types, though slowly as compared to inoculated soils; but nitrate and carbon dioxide were not formed. Resting cells of a bacterium, Pseudomonas sp. ATCC 29353, readily hydrolyzed parathion and then liberated nitrite from p-nitrophenol. In cell-free suspension, the reaction ceased at the p-nitrophenol stage. In bacterial cultures, parathion was hydrolyzed without proliferation while subsequent degradation of p-nitrophenol involved metabolism leading to bacterial enrichment. (Skogerboe-Colorado State)
W79-05936

5B. Sources Of Pollution

NITRATES AND BACTERIAL DISTRIBUTION IN RURAL DOMESTIC WATER SUPPLIES,
Texas Univ. Health Science Center at Houston. School of Public Health.
D. Brooks, and I. Cech.
Water Research, Vol. 13, No. 1, p 33-41, 1979. 5 fig, 1 tab, 24 ref. NIH IA04AHZ12201.

Descriptors: *Water quality, *Bacteria, *Nitrates, *Texas, Sampling, Wells, Water wells, Rural areas, Water pollution, Water pollution sources, Domestic water, Pollutants, Coliforms, Streptococcus, Nitrogen compounds, Farm wastes, Septic tanks, Data processing, *Houston County(TX).

The protection of underground water resources is an important facet of the Safe Drinking Water Act. Effective intervention strategy for active source protection requires up-to-date information on groundwater quality and the knowledge of potential sources and causes of contamination. In the present study, the state of well water supplies in rural East Texas was evaluated in order to develop a practical approach to surveying water sources in 'back-country' areas, which would allow the differentiation of natural from anthropogenic factors affecting water quality. The specific focus was on nitrates, their extent, causes, and sources in rural well water. Data were processed using synographic mapping which permitted the comparison of the natural tendency in distribution of nitrates with the patterns induced by man's activities. Trend surface analysis of data indicated that the surveyed Tertiary and Quaternary sands were not naturally nitrate-rich. Localized and well-defined spots of nitrates, many times in excess of the background, were traceable to the anthropogenic sources. The study identified the characteristics of high risk wells. (Sims-ISWS)
W79-05524

SORPTION AND ACCUMULATION OF CADMIUM IN THE SEDIMENT OF THE TAMA RIVER,
Tokyo Univ. (Japan). Inst. of Industrial Science.
For primary bibliographic entry see Field 5A.
W79-05525

TWO-DIMENSIONAL BUBBLE PLUMES,
New South Wales Univ., Kensington (Australia). Water Research Lab.
For primary bibliographic entry see Field 8B.
W79-05539

GEOHYDROLOGICAL RESEARCH AT THE CHALMERS UNIVERSITY OF TECHNOLOGY, GOTEBORG.
For primary bibliographic entry see Field 4C.
W79-05546

SOME ASPECTS ON URBAN RUNOFF QUALITY MODELING,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Water Supply and Sewerage.
G. Svensson.

Descriptors: *Urban runoff, *Water quality, *Model studies, Mathematical models, Water pollution, Water pollution sources, Storm runoff, Pollutants, Suspended solids, Path of pollutants, Surface runoff, Cities, Urban hydrology, *Sweden.

At Chalmers University of Technology, urban runoff quantity and quality have been subject to investigation since 1970. These investigations have increased knowledge of the composition of urban storm water and the quality variations. Attempts to correlate the constituent concentrations to runoff intensity, runoff duration, or time to antecedent rainfall have not succeeded very well. Although there is some correlation between the concentrations and these factors, no simple equations can be given. Therefore, the research has been concentrated on the question of what causes storm water pollution. During the last year, an investigation has been carried out aimed at quantifying the sources of storm water pollutants. (See also W79-05546) (Sims-ISWS)
W79-05549

NONPOINT SOURCE POLLUTION,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr.
Preprint 3461, American Society of Civil Engineers, for ASCE Convention and Exposition, Boston, Mass., April 2-6, 1979. 16 p, 22 ref. OWRT A-025-N.J.(12), B-063-N.J.(3), (B-059-N.J.)(3), 14-31-0001-3830, 14-34-0001-7124.

Descriptors: *Federal Water Pollution Control Act, Management, *Planning, *Water pollution effects, Heavy metals, Institutions, Biochemical oxygen demand, Nutrients, *Water pollution sources, *Nonpoint pollution, Hydrocarbons.

The control of pollution from urban runoff and other nonpoint sources will be necessary if water quality objectives are to be reached. In fact, in urbanizing areas, it will be necessary to avoid further degradation of stream quality. Realistically, where no Federal funding is available, and no Federal coercive power is practicable to exert, programs of this nature can only be adopted to the extent that the proposed program is clearly related to an objective of local concern. Unfortunately, the accurate estimation of nonpoint source pollution is difficult and time consuming, and, for this reason, the initial phase of 208 planning did not generally succeed in characterizing runoff pollution and the nature of the problems in the various waterways. Therefore, more efficient and economical programs to do this must be devised, which may start with streamwalking and surveillance. Remedial management programs to be funded must be cost effective, and must consider aspects of flooding, erosion, and water supply as well as water quality. Means adopted may include detention requirements placed upon developers in the joint interest of flood retardation and water quality. A great deal more research and data gathering would be desirable to develop better technology and conduct detailed planning; but so far the issue has only moderately impressed Federal authorities. If the urgent situations arising in lakes and streams are to be handled successfully, supplementary local funding and good engineering judgment are going to be necessary.
W79-05582

WATER-SUPPLY POTENTIAL OF THE LOWER HILLSBOROUGH RIVER, FLORIDA, 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4A.
W79-05586

MONTHLY FLUCTUATIONS IN THE QUALITY OF GROUND WATER NEAR THE WATER TABLE IN NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
B. G. Katz, S. E. Ragone, and J. B. Lindner.
Geological Survey Water-Resources Investigations 78-41, 1978. 38 p, 10 fig, 4 tab, 38 ref.

Descriptors: *Water quality, *Groundwater, *Water pollution sources, *Septic tanks, *Storm runoff, Fertilizers, Precipitation(Atmospheric), Nitrates, Chlorides, Sulfates, New York, *Long

Island, *Nassau County, *Suffolk County, Deicing salts.

Water samples from wells in a sewered and an unsewered suburban area and an unsewered rural area on Long Island, N.Y. were collected and analyzed monthly from August 1975 to July 1976 to determine the concentrations of chloride, sulfate, and nitrate in ground water near the water table. Short-term and seasonal fluctuations in concentrations of these substances were evaluated to determine their relation to nonpoint discharges. Major factors that may cause concentrations of these substances to fluctuate at any particular site are precipitation, lawn fertilizer, dissolved salts in storm runoff, and effluent from septic tanks and cesspools. Chloride concentrations during the study fluctuated by as little as 2 milligrams per liter (mg/liter) at some sites and as much as 300 mg/liter at others. Nitrate and sulfate concentrations showed essentially no change at some sites but fluctuated by as much as 8 and 40 mg/liter, respectively, at others. Short-term fluctuations in the concentrations of these substances in ground water seem to have no consistent correlation with type of land use (suburban or agricultural) or precipitation but seem to be related to seasonal variations in input from specific nonpoint sources. (Woodard-USGS)
W79-05587

QUALITY OF THE WATER IN BORROW PONDS NEAR A MAJOR HIGHWAY INTERCHANGE, DADE COUNTY, FLORIDA, OCTOBER-NOVEMBER 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
T. R. Beaven, and B. F. McPherson.
Geological Survey open-file report 78-1029, 1978. 15 p, 3 fig, 7 tab, 8 ref.

Descriptors: *Water quality, *Water pollution sources, *Highway effects, *Surface waters, *Aquatic environment, Ponds, Sampling, Chemical analysis, Water analysis, Bottom sediments, Trace elements, Chromium, Lead, Dieldrin, Iron, Manganese, Zinc, Polychlorinated biphenyls, Phenols, *Florida, *Dade County(FL), *Vehicular pollution, *Borrow Ponds(FL).

Water, bottom sediment, and aquatic plants were sampled from ponds near a major south Florida highway interchange to document concentrations of selected constituents in an aquatic environment near heavy vehicular traffic. Generally, concentrations of constituents were within the range expected in an uncontaminated environment in south Florida. However, concentrations did exceed south Florida background levels or Environmental Protection Agency criteria in a few cases. Two trace elements--chromium (20 micrograms per liter) in ponded surface water and lead (500 micrograms per gram) in bottom sediment--exceeded background levels. Concentrations of dieldrin (22 micrograms per kilogram) and polychlorinated biphenyls (53 micrograms per kilogram) also exceed background levels in bottom sediment. The concentration of phenol (23 micrograms per liter) in ground water exceeded Environmental Protection Agency quality criteria by 22 micrograms per liter, but was within the background range for south Florida. Ten metals were detected in the cattail or algal samples, but only iron, manganese, and zinc were in higher concentrations than those in the bottom sediment. (Woodard-USGS)
W79-05589

DYE-DISPERSION STUDY AT PROPOSED PUMPED-STORAGE PROJECT ON HUDSON RIVER AT CORNWALL-ON-THE-HUDSON, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
B. Dunn, and G. C. Gravlee, Jr.
Geological Survey open-file report 78-589, July 1978. 40 p, 16 fig, 1 tab, 6 ref.

Descriptors: *Path of pollutants, *Dye dispersion, *Tidal effects, *Mixing, *Hudson River, Estuaries, Baseline studies, Fluorescent dye, Rhodamine, Tracking techniques, Pumped storage, Planning, New York.

Data were collected during a dye-dispersion study on a 6-mile, tide-affected reach of the Hudson River near the proposed Cornwall Pumped Storage Project on September 21-22, 1977. The results indicated that complete mixing did not occur during the first tidal cycle but was complete after two or more cycles. The fluorometric dye-tracing procedure was used to determine the dispersion characteristics of the water mass. Rhodamine WT dye, 20-percent solution, was continuously injected on the west side of the river throughout an ebb tide, and its movement was monitored during a 30-hour period. Samples were collected both individually and continuously. Automatic dye samplers were used at selected cross sections near each bank. Bathymetric measurements were made at eight cross sections between Newburgh and West Point to determine the depths. (Woodard-USGS)
W79-05596

RECORD OF WELLS IN THE FLORIDAN AQUIFER IN DADE AND MONROE COUNTIES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-05606

SEASONAL CYCLING OF CESIUM-137 IN A RESERVOIR,
Savannah River Ecology Lab., Aiken, SC.
J. J. Alberts, L. J. Tilly, and T. J. Vigerstad.
Science, Vol. 203, No. 4381, p 649-651, February 16, 1979. 4 fig, 16 ref. Dept. of Energy EY-76-C-09-0819, AT(07-2)-1.

Descriptors: *Cesium, *Reservoirs, *Sediments, *Variability, Seasonal, Cooling water, Radioisotopes, Nuclear wastes, Pollutants, Water pollution, Path of pollutants, Sampling, On-site investigations, Seasonal cycling, Cesium-137.

Studies of a reservoir in the southeastern United States showed that cesium-137, introduced into the system from a leak in a nuclear fuel element, cycles between the water and sediment on a seasonal basis. The cycling, which coincides with the annual periods of thermal stratification in this monomictic lake, has been occurring for over 10 years. (Sims-ISWS)
W79-05622

DISTRIBUTION OF SUSPENDED BACTERIA IN THE NEWPORT RIVER ESTUARY, NORTH CAROLINA,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
For primary bibliographic entry see Field 2L.
W79-05623

ACID PRECIPITATION IN THE NEW YORK METROPOLITAN AREA: ITS RELATIONSHIP TO METEOROLOGICAL FACTORS,
Interstate Sanitation Commission, New York.
For primary bibliographic entry see Field 2K.
W79-05626

SOURCES AND FATES OF AROMATIC COMPOUNDS IN URBAN STORMWATER RUNOFF,
Environmental Protection Agency, Edison, NJ. Surveillance and Analysis Div.
For primary bibliographic entry see Field 5A.
W79-05627

SEASONAL CHANGES IN OXYGEN UPTAKE BY SETTLED PARTICULATE MATTER AND SEDIMENTS IN A MARINE BAY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology lab.
For primary bibliographic entry see Field 2L.
W79-05638

LOSS RATES OF SUSPENDED MATERIAL SEDIMENTED IN A MARINE BAY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 2L.
W79-05639

ORIGIN OF DEPOSITED MATERIAL SEDIMENTED IN A MARINE BAY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 2L.
W79-05640

NITROGEN AND CHLORIDE MOVEMENT IN SMALL UPLAND PIEDMONT WATERSHEDS: I. NITRATE-NITROGEN AND CHLORIDE DISTRIBUTION IN SOIL PROFILES,
Southern Piedmont Conservation Research Center, Walkinsville, GA.
G. W. Langdale, R. A. Leonard, W. G. Fleming, and W. A. Jackson.
Journal of Environmental Quality, Vol. 8, No. 1, p 49-57, January-March 1979. 6 fig, 4 tab, 16 ref.

Descriptors: *Nitrogen, *Chlorides, *Soil profiles, Fertilizers, Soil water, Groundwater, Watersheds(Basins), Crops, Sampling, Chemicals analysis, Rainfall, Runoff, Storm runoff, Soil texture, Nitrates, Nutrients, Water pollution, Pollutants, Water pollution sources, Agricultural watersheds, Agriculture, Nonpoint water pollution sources.

Soil profile characteristics of many soils are related to the partitioning of fertilizers for soil pool, plant uptake, overland transport, and deep seepage. Chloride and NO3-N distribution patterns were studied on variable soil profiles of two small agricultural watersheds planted to corn. Management variables included grassed waterways, graded terraces, and winter rye cover crops. Landscape slope and soil characteristics of the surface and control section layers were inherent variables within and among watersheds. Average soil Cl concentrations decreased from 275 ppm to background levels (30 ppm) at the 0- to 8-cm soil depth within 40 days after spring-incorporated applications of Cl fertilizer (112 kg Cl/ha as KCl). Nitrogen fertilizers (about 140 kg N/ha per year) were applied in split applications to meet optimum corn-growth demands. Average NO3-N concentrations ranged from 20 to 40 ppm at the 0- to 8-cm depth immediately after N-fertilizer applications, but decreased rapidly because of biological assimilation. (See also W79-05642) (Sims-ISWS)
W79-05641

NITROGEN AND CHLORIDE MOVEMENT IN SMALL UPLAND PIEDMONT WATERSHEDS: II. NITROGEN AND CHLORIDE TRANSPORT IN RUNOFF,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
G. W. Langdale, R. A. Leonard, W. G. Fleming, and W. A. Jackson.
Journal of Environmental Quality, Vol. 8, No. 1, p 57-63, January-March 1979. 2 fig, 6 tab, 16 ref.

Descriptors: *Nitrogen, *Chlorides, *Runoff, Fertilizers, Watersheds(Basins), Agricultural watersheds, Sampling, Chemical analysis, Rainfall, Nutrients, Sediments, Pollutants, Water pollution, Water pollution sources, Agriculture, Hydrology, Nonpoint water pollution sources.

Selective management practices were used on two upland Southern Piedmont watersheds to assess their influence on overland transport of Cl, soluble-N, and total Kjeldahl-N (TKN). Ammonia-N and TKN were measured in both runoff water and sediment phases and related to these transport modes. Chloride (112 kg Cl/ha) served as a tracer anion because of its inert biological activity. Optimum rates of N-fertilizer (about 140 kg N/ha) were applied in recommended split-applications for corn growth. Annual NH4-N and TKN losses were 35 to 40% less when associated with terraces and double cropping of corn and winter rye than

from a watershed without conservation practices. This difference was related primarily to difference in sediment yield from the two watersheds. No real annual differences were detected for Cl and NO3-N losses between watersheds. Total seasonal nutrient losses were strongly affected by the quantity of sediment transported during highly erosive periods of May, June, and July. (See also W79-05641) (Sims-ISWS)
W79-05642

NITRATE MOVEMENT IN A CHILEAN AGRICULTURAL AREA IRRIGATED WITH UNTREATED SEWAGE WATER,
Chile Univ., Santiago. Dept. of Inorganic and Analytical Chemistry.
E. B. Schalscha, I. Vergara, T. Schirado, and M. Morales.
Journal of Environmental Quality, Vol. 8, No. 1, p 27-30, January-March 1979. 1 fig, 5 tab, 15 ref.

Descriptors: *Irrigation, *Sewage effluents, *Nitrate, *Groundwater, Municipal wastes, Industrial wastes, Leaching, Foreign countries, Travel time, Foreign research, Water quality, Water pollution, Water pollution sources, Pollutants, Nitrogen compounds, On-site investigations, On-site data collections, Crops, Vegetable crops, Public health, Water wells, Agriculture, *Chile.

Nitrate concentrations in soils and drainage and well waters were determined in a 15-ha field representing about 4,000 ha of agricultral land irrigated exclusively with raw sewage water for more than 25 years. Analyses of the percolating water below the root zone indicated that the leached NO3(-)-N was about 350 kg/ha per year. The transit time for water to move through the unsaturated zone to the saturated zone at a depth of 2 to 2.2 m was less than 1 year, and the leaching fraction was estimated as 0.63. Concentrations of NO3(-)-N ranged from 20 to 35 mg/liter in the percolating water of the unsaturated zone, whereas two well waters contained 9 and 14 mg/liter. (Sims-ISWS)
W79-05643

MAN'S IMPACT ON THE MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT--SYMPOSIUM SUMMARY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
M. G. Gross, R. L. Swanson, and H. M. Stanford.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.). American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 1-13, 1976. 2 fig, 1 tab, 55 ref. Allen Press, Inc., Lawrence, Kansas.

Descriptors: *Resources development, *Water pollution sources, *Water pollution effects, *Baseline studies, *Environmental effects, Oil pollution, Polychlorinated biphenyls, Sewage sludge, Waste disposal, Sediment transport, Bottom sediments, Public health, *Outer Continental Shelf, *Ocean dumping, *New York Bight.

Human activities in coastal ocean areas are causing ever-increasing concern, especially near urban regions. Serious questions have been raised about the impact on this coastal ecosystem of releasing wastes and contaminants, siting power plants, and drilling for oil on the continental shelf. The symposium considered the environmental quality of the middle Atlantic continental shelf and New York Bight and assessed man's impact on this continental shelf ecosystem. Particular attention was given to applications of research results to questions of public policy and resource allocation in addressing man-related environmental changes. These results are summarized and an attempt is made to place them in a regional and national perspective. (Sinha-OEIS)
W79-05679

PHYSICAL OCEANOGRAPHY OF THE MIDDLE ATLANTIC BIGHT,
Woods Hole Oceanographic Institution, MA.; Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.; and National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 2J.
W79-05680

OCEAN-ATMOSPHERE INTERACTIONS OFF THE NORTHEAST COAST OF NORTH AMERICA,
National Marine Fisheries Service, Seattle, WA. Northwest Fisheries Center.
T. Laevast, J. Harding, K. Rabe, and S. Larson.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.). American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 35-43, 1976. 12 fig, 11 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Baseline studies, *Air pollution effects, *Water pollution sources, Air-water interfaces, Water quality, *Outer Continental Shelf, *New York Bight, Ocean-atmosphere, Sea-air interaction, United States Northeast coast.

The New York Bight-middle Atlantic continental shelf region is typical of midlatitude continental east coast areas in the intense sea-air interaction occurring during late autumn and winter. During these seasons dry but cool air moving over warm coastal water takes up a considerable amount of heat and moisture (latent heat). The daily uptake near the coast can exceed 0.5 g of water per sq cm on a monthly mean basis. The response of the surface layers of the atmosphere to the properties of the sea surface is relatively rapid so that quasi-equilibrium conditions are established after surface air has traveled about 6 h over water. The main consequences of this large heat and moisture uptake on the atmosphere are deepening of lows that pass the coastline and frequent cyclogenesis off the coast. As the heat and moisture are transported upward, a trough forms at the 850-mb level. A thermally driven cyclonic surface wind component is created along the coast, but it often escapes the attention of synoptic weather analysis. The main effect of the atmosphere on the ocean is rapid cooling of already cool coastal waters during autumn and winter, resulting in increases in thermocline depth. The coastal southerly current is influenced by the surface cyclonic wind component. (Sinha-OEIS)
W79-05681

NEW YORK BIGHT WATER STRATIFICATION--OCTOBER 1974,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 1A.
W79-05682

DISTRIBUTION OF HYDROGRAPHIC PROPERTIES IN THE NEW YORK BIGHT APEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 1A.
W79-05683

SURFICIAL SEDIMENTS OF THE NOAA-MESA STUDY AREAS IN THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.; and Adelphi Univ., Garden City, NY.
G. L. Freeland, D. J. P. Swift, W. L. Stubblefield, and A. E. Cok.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 90-101, 1976. 13 fig, 2 tab, 36 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Spoil banks, *Water pollution, Sediments, Sewage sludge, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Surficial sediments, Dredged material.

In the New York Bight apex, extensive sedimentological studies and a 1973 bathymetric survey reveal that the only significant change in bottom topography since 1936 occurred at the dredge spoil dumpsite where the sumping of dredged material has caused up to 10 m shoaling. The center of the Christiaensen Basin, a natural collecting area for fine-grained sediment, is no doubt contaminated with sludge but shows no apparent sediment buildup during the intervening 37 years. The apex outside of the Christiansen Basin is floored primarily by sand ranging from silty fine to coarse, with small areas of sandy gravel, artifact (anthropogenic) gravel, and mud. Nearshore mud patches appear to be covered at times with sand and occasionally scoured out. Sidescan sonar records show linear bedforms, indicative of sand movement, over most of the apex area. Two midshelf areas have been proposed as interim alternative dumping areas. The northern area is in a tributary valley of the ancestral Long Island river system. Fine sands cover the northeast part and medium sands predominate to the west and south. Bottom photographs show a smooth, slightly undulatory, mounded or rippled sea floor. In the southern alternative dumping area coarse sand and gravel deposits lie on the crest and east flank of the Hudson divide, while medium and fine sand occurs in the ridge and swale topography to the west. These distributions suggest fine sediment is winnowed from the crest and east flank of the divide and deposited to the west. Veatch and Smith Trough contains a veneer of shelly, pebble sand with large, angular clay pebbles and occasional oyster shells derived from exposed early Holocene lagoonal clay. These studies suggest that if sewage sludge were dumped, widespread dispersion, mostly to the southwest, could be expected, with winter resuspension and transport of fine material on the bottom. Possible permanent buildup on the bottom could be expected if dredged material were dumped. (Sinha-OEIS)
W79-05685

DEVELOPMENTAL TESTS ON THE USE OF FLUORESCENT TRACERS AND BACKWASH SEDIMENT-LOAD SAMPLERS TO MEASURE THE BEACH DRIFT COMPONENT OF LITTORAL TRANSPORT AT SANDY HOOK, NEW JERSEY,
Teachers Coll., New York. Dept. of Science Education.
For primary bibliographic entry see Field 2J.
W79-05688

SOURCES OF URBAN WASTES,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
M. G. Gross.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 150-161, 1976. 4 fig, 7 tab, 39 ref. Allen Press Inc., Lawrence, Kansas. Also as: Chesapeake Bay Contribution 227.

Descriptors: *Water pollution sources, *Water pollution effects, *Waste disposal, Environmental effects, Sediment transport, *Outer Continental Shelf, *New York Bight, *Ocean dumping.

The coastal ocean has long been used by cities along the Middle Atlantic Bight--particularly in the New York-New Jersey metropolitan region--to dispose of municipal, industrial, and dredged wastes; the volumes increased by more than 5% per year in the early 1970s. Sediment eroded from agricultural land and from construction sites must be dredged from navigation channels after deposition by rivers. Solids from sewage (treated and untreated) mix with the riverborne sediments so that large volumes of dredged materials must be handled as wastes. Riverborne sediment load and

littoral drift must be dredged from navigation channels; that material is now dumped at sea. Industrial wastes, such as from titanium dioxide prduction and coal ash, have been dumped at sea. Others, such as steel-making slag, have been used for landfill. Construction and demolition debris have been dumped at sea when no landfill sites were available. Refuse, garbage, and incinerator ash are commonly disposed of in coastal wetlands. Alternatives disposal strategies and sites will be needed to supplement present regulations to reduce the urban wastes now dumped at sea. (Sinha-OEIS)
W79-05689

CONTAMINANTS ENTERING THE NEW YORK BIGHT: SOURCES, MASS LOADS, SIGNIFICANCE,
Manhattan Coll., Bronx, NY. Dept. of Environmental Engineering and Science.
J. A. Mueller, A. R. Anderson, and J. S. Jeris.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 162-170, 1976. 10 fig, 5 tab, 4 ref. Allen Press Inc., Lawrence, Kansas. NOAA-MESA-04-4-002-35.

Descriptors: *Water pollution sources, *Waste disposal, Wastewater disposal, Urban runoff, Heavy metals, Cadmium, Lead, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Dredge spoil.

Major contaminant inputs to the New York Bight originate from the New York metropolitan area and the Hudson River drainage basin, principally from wastewater, runoff, and barged discharges. Major sources of the microbial load are unchlorinated municipal wastewater discharges and urban runoff. Sewage sludge barge dumps constitute an insignificant microbial load on bight waters. The seasonal variability of municipal wastewater and gauged runoff and annual variability of barge discharges range from a maximum of 1.5-2.0 to a minimum of 0.5-0.7 times the average mass loads. Between 1960 and 1975 the sludge volume as well as fraction digested shows a definite increasing trend. Few data are available on atmospheric and urban runoff inputs. The mass loads reaching the bight are highly related. Poor quality of the dredged materials is caused by contaminants settling from poorly treated wastewater and urban runoff. Increasing levels of wastewater treatment produce more municipal and industrial sludge for disposal. For conservative substances, such as heavy metals, various control measures may redistribute the load among the sources but cause no net decrease in the total. (Sinha-OEIS)
W79-05690

TRACE METALS IN THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
D. A. Segar, and A. Y. Cantillo.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 171-198, 1976. 35 fig, 4 tab, 36 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Water pollution sources, *Waste disposal, *Heavy metals, Environmental effects, Copper, Zinc, Cadmium, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Dredge spoil.

Large quantities of trace metals are introduced to the New York Bight apex from many sources. Distribution of dissolved Mn, Fe, Cd, Cu, and Zn are extremely nonuniform in the waters of the apex due to the many sources and complex reactions taking place. Estuarine discharge and dredge spoil dumping are major sources, while sewage sludge and acid waste dumping are minor sources for most elements studied. Much of the dissolved Cu and Fe occurs in a chemical form that is not extractable by chelation/solvent extraction, even after acidification. The quantity of this metal fraction increases with distance from the Hudson-Raritan estuary. Loss from solution of some elements, notably Mn, occurs when estuarine water mixes with oceanic water. Metals, particularly Zn, are released to solution during ocean dumping of sewage sludge and other materials. Concentrations of dissolved metals in the apex are higher than on the open shelf and higher in summer than in spring and fall. This suggests that the apex flushes slower in summer, as inputs do not vary significantly with season. Budget calculations show that contaminant metals, exemplified by Cu and Zn, do not accumulate in the apex but are rapidly removed either to the estuaries or the surrounding shelf waters. Mean residence times of contaminant metals in the apex waters are less than 6 months, perhaps considerably less. (Sinha-OEIS)
W79-05691

PRELIMINARY ANALYSIS OF THE DISPERSION OF SEWAGE SLUDGE DISCHARGED FROM VESSELS TO NEW YORK BIGHT WATERS,
Corvallis Environmental Research Lab., OR. Marine and Freshwater Ecology Branch.
R. J. Callaway, A. M. Teeter, D. W. Browne, and G. R. Distsworth.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 199-211, 1976. 9 fig, 2 tab, 8 ref. Allen Press, Inc., Lawrence, Kansas.

Descriptors: *Water pollution, *Dispersion, Sewage sludge, Waste disposal, *Outer Continental Shelf, *New York Bight, *Ocean dumping.

New York City sewage treatment plant wastes discharged to the New York Bight apex average 2.6% solids. Correlation of extinction coefficient from a 10-cm light-path beam-transmissometer with total suspended matter (TSM) allowed continuous profiling of TSM. STD and beam transmittance profiles were made either by towing the instrument through a sludge patch or wake or by making vertical profiles. Dilution from a near-instantaneous release was on the order of 1,000 within 10 min of release. Dilution in the wake of a release ranged from 500-1000. The time for TSM to reach background or equilibrium values depends on initial concentration. Equilibrium time was approached exponentially for well mixed conditions in about 5.5 h. Pycnocline formation in the upper 8 m caused a similar approach to equilibrium time; below that depth TSM increased slightly with time. TSM from New York Harbor can reach the permit area, but oceanographic conditions in the apex usually prevent this. Relocating the permit area to other deeper areas would cause the affected bottom area to increase in proportion to the increased depth, but concentrations of settled-out material would be inversely proportional, if the oceanographic environment was similar. (Sinha-OEIS)
W79-05692

RARITAN BAY AS A SOURCE OF AMMONIUM AND CHLOROPHYLL A FOR THE NEW YORK BIGHT APEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. H. Parker, I. W. Duedall, H. B. O'Connors, Jr., and R. Wilson.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 212-219, 1976. 9 fig, 8 ref. Allen Press Inc., Lawrence, Kansas. Also as: SUNY, Marine Sciences Research Center Contribution 169.

Descriptors: *Baseline studies, Chlorophyll a, Ammonium compounds, Nutrients, Ecosystems, Water quality, Water resources, *Outer Continental Shelf, *New York Bight.

Measurements in June 1974 and 1975 in Raritan, Sandy Hook, and Lower New York Bays showed that water nearest Sandy Hook had low salinity and high Chlorophyll a and NH4+ concentrations. Sandy Hook Bay had the highest Chlorophyll a values and low NH4+ concentrations. High Chlorophyll a concentrations were also found at the center of Raritan Bay accompanied by high NH4+ concentrations. Near Rockaway Inlet, NH4+ concentrations were high while Chlorophyll a values were minimal. The Narrows also showed high NH4+ and low Chlorophyll a concentrations. By comparing the salinity, ammonium, and chlorophyll a distributions at the Sandy Hook-Rockaway Point transect with the characteristics of the different sources of water flowing out to the bight, an identification of water masses at the transect is possible. (Sinha-OEIS)
W79-05693

OXYGEN DEPLETION IN THE NEW YORK BIGHT APEX: CAUSES AND CONSEQUENCES,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
D. A. Segar, and G. A. Berberian.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 220-239, 1976. 20 fig, 35 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Dissolved oxygen, *Waste disposal, *Water pollution sources, *Water pollution effects, Environmental effects, Sewage sludge, *Outer Continental Shelf, *New York Bight, Ocean dumping, Dredge spoil.

Dissolved oxygen concentrations in waters of the New York bight apex are near saturation except in summer when a stable thermocline exists and concentrations in the lower layer can drop to 10% of saturation. Mass balances of oxygen and carbon cycles in the apex were examined. Photosynthetically produced carbon accounts for most of the oxygen demand, particularly in summer. Oxygen demand due to sewage sludge and dredge spoils is small compared to that from organic carbon produced in situ. Oxygen demand of particulate and dissolved organics in the estuarine discharge may be as great as the sewage sludge and dredge spoils together. Midsummer primary productivity in the apex is high due to nutrient inputs, particularly nitrogen. Most nitrogen, supplied to the apex in forms suitable to support photosynthetic production, comes from the discharge of the Hudson-Raritan-Passaic systems. Most of this nitrogen comes from liquid effluents of sewage treatment plants discharged to the rivers. Ocean dumping in the bight apex does not cause the low oxygen concentrations found in summer. These are caused primarily by nitrogen supply from rivers. Improvement in dissolved oxygen concentrations could be achieved by removing nitrogen from sewage treatment plant effluents. (Sinha-OEIS)
W79-05694

CARBOHYDRATES AND ORGANIC CARBON IN NEW YORK BIGHT SEDIMENTS AS POSSIBLE INDICATORS OF SEWAGE CONTAMINATION,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
P. G. Hatcher, and L. E. Keister.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 240-248, 1976. 6 fig, 1 tab, 25 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Carbohydrates, *Organic compounds, *Water pollution sources, *Waste disposal, Sediments, Beaches, Sewage sludge, *Outer Continental Shelf, *New York Bight, Ocean dumping.

Sediments of the New York Bight were analyzed for total organic carbon (TOC) and total carbohydrates (TCH). The TCH:TOC ratio was significantly more elevated than comparable sediments from other areas. High TCH:TOC values may be attributed to sewage-derived materials which contribute significant quantities of refractory organic matter to the bight annually. Nonanthropogenic sources of organic matter to these sediments have little or no influence on TCH:TOC except near the shelf break. The TCH:TOC ratio may be useful as a qualitative and semiquantitative indicator of sewage-derived organic matter in sediment deposits. The observed TCH:TOC ratios suggest that organic material being deposited in the Christiaensen Basin and mud patches near Long Island is predominantly of sewage origin, and that seaward of the apex, the sedimentary organic matter becomes less influenced by sewage-derived organic matter and oceanic organic matter becomes a more significant fraction. (Sinha-OEIS)
W79-05695

A CONCEPTUAL REPRESENTATION OF THE NEW YORK BIGHT ECOSYSTEM,
Resource Management Associates, Lafayette, CA.; and Tetra Tech, Inc., Lafayette, CA.
D. B. McLaughlin, and J. A. Elder.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 249-259, 1976. 4 fig, 1 tab, 25 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Ecosystems, *Models, *Productivity, Water quality, Environmental effects, Water pollution effects, *Outer Continental Shelf, *New York Bight, Ocean dumping.

Large scientific enterprises need effective techniques for organizing and relating research findings from different fields. Graphical representations (or models) of the ecosystem can be particularly useful organizational tools. These conceptual models help lay the groundwork for detailed mathematical or empirical descriptions of ecological processes; they also demonstrate the scope of the problem being studied. The New York Bight ecosystem model discussed here is based on a descriptive technique developed by H.T. Odum and widely applied by others. The model is constructed from a few basic components which fall into the following categories: energy or mass storage compartments; energy or mass sources; energy or mass flow regulators. These components are pieced together into a comprehensive representation of physical, chemical, and biological processes in the bight. Selected aspects of the representation are examined and, where possible, mass and energy fluxes are estimated. (Sinha-OEIS)
W79-05696

PHYTOPLANKTON PRODUCTIVITY IN THE APEX OF THE NEW YORK BIGHT: ENVIRONMENTAL REGULATION OF PRODUCTIVITY/CHLOROPHYLL A,
City Coll., New York. Dept. of Biology.
T. C. Malone.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 260-272, 1976. 13 fig, 1 tab, 31 ref. Allen Press Inc., Lawrence, Kansas. NOAA-MESA-03-4-043-310.

Descriptors: *Productivity, *Chlorophyll, Phytoplankton, Nitrogen, Environmental effects, Water pollution effects, *Outer Continental Shelf, *New York Bight, Ocean dumping.

Phytoplankton productivity within a 600 sq km area of the New York Bight apex ranged from a December minimum to a June maximum. Netplankton productivity peaked in February and June; nanoplankton productivity was highest in June and July. Productivity was restricted to within 20 km of the mouth of the Hudson-Raritan estuary. Netplankton and nanoplankton accounted for 41% and 59% of the annual phytoplankton production. The supply of dissolved inorganic nitrogen from the Hudson estuary exceeded phytoplankton demand except during June, July, and August when regeneration within the apex was an important source of nitrogen. No evidence of nitrogen-limited phytoplankton growth was found. Evidence shows that chlorophyll a specific phytoplankton productivity was regulated by light and temperature. Ocean dumping had no observable effect on phytoplankton assimilation numbers or on the distribution of environmental factors regulating phytoplankton growth in the apex. (Sinha-OEIS)
W79-05697

EFFECTS OF COASTAL POLLUTION ON FISH AND FISHERIES--WITH PARTICULAR REFERENCE TO THE MIDDLE ATLANTIC BIGHT,
National Marine Fisheries Service, Highlands, NJ. Middle Atlantic Coastal Fisheries Center.
For primary bibliographic entry see Field 5C.
W79-05699

ACCOMPLISHMENT PLAN, REGION VIII. RED RIVER OF THE NORTH BASIN.
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 5G.
W79-05722

FREQUENCY AND EXTENT OF WIND-INDUCED RESUSPENSION OF BOTTOM MATERIAL IN THE U.S. GREAT LAKES NEARSHORE WATERS,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 2J.
W79-05736

CHEMISTRY OF PHOSPHORUS, CADMIUM, COPPER, NICKEL, LEAD, AND ZINC IN INDIANA LAKE AND RESERVOIR SEDIMENTS,
Purdue University Water Resources Research Center, West Lafayette, Indiana.
E. D. Orme, and D. W. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 428, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No. 122. January 1979. 116 p, 50 fig, 32 tab, 49 ref, 1 append. OWRT A-044-IND(2).

Descriptors: *Lake sediments, *Sediment-water interfaces, *Eutrophication, *Phosphorus, *Heavy metals, Metals, Reservoirs, Mud-water interfaces, Bottom sediments.

Soluble inorganic phosphorus is presumed to be the key element in the eutrophication process of a body of water. The objective of the study was to characterize the chemistry of phosphorus and selected heavy metals in sediments from Indiana lakes and reservoirs. Studies were made on the forms and amounts of P, Cd, Cu, Ni, Pb, and Zn initially present in sediments, the capacities of sediments to sorb added phosphorus and metals, and the nature of the mechanisms for phosphorus and metal retention. Results showed that all the sediments had high sorptive and desorptive capacities, although each sediment studied had a unique desorption characteristic. Statistical correlations between sediment parameters revealed that sediment desorption of P was directly related to the degree of eutrophication in the body of water. Because of high positive correlation, the NH4F-extractable Al and amorphous Fe and Al were most likely the sediment compounds involved with the equilibrium sorption-desorption of phosphorus. Heavy metals were also highly sorbed. Sediments retained or released sorbed metals in the general order of Ni was more easily released while Cu and Cd were more strongly retained. (Wiersma-Indiana)
W79-05794

EFFECT OF ENVIRONMENTAL FACTORS ON SURVIVAL OF SALMONELLA TYPHIMURIUM IN SOIL,
Missouri Univ., Columbia. Dept. of Agronomy.
L. M. Zibilske, and R. W. Weaver.
Journal of Environmental Quality, Vol. 7, No. 4, p 593-597, October-December, 1978. 6 tab, 18 ref.

Descriptors: Waste disposal, Pathogenic bacteria, Laboratory tests, *Salmonella, *Soil bacteria.

This investigation was undertaken in the laboratory to determine how accurately salmonella survival can be predicted when environmental conditions are known. Salmonella typhimurium was inoculated into two Texas soils, a clay and a fine sandy loam, using cattle manure slurry and saline as inoculum carriers. Soil samples were incubated in the laboratory at three temperatures and moistures: 5, 22, and 39C; and 0, 0.5, and >22 atm tension, respectively. Survival was monitored for 12 weeks by direct spread plating of soil dilutions onto dulcitol-iron thiosulfate (DIT) medium developed for this experiment. The DIT medium restricted growth of normal soil microflora but allowed growth and differentiation of S. typhimurium. Statistical evaluation of treatment effects was complex because of three factor interactions. Soil moisture and temperature interacted as did soil moisture and inoculation method. Time as a factor strongly interacted with moisture, soil, and temperature. S. typhimurium died within 1 week in dry soil incubated at 39C. For some treatment combinations incubated at 39C, interactions occurred that resulted in survival to 42 days. Survival at 5 and 22C was comparable and usually longer than at 39C. Salmonella populations increased in some samples at 3 days but declined afterward. (Skogerboe-Colorado State)
W79-05807

NITROGEN INPUTS AND LOSSES IN TOBACCO, BEAN, AND POTATO FIELDS IN A SANDY LOAM WATERSHED,
Department of Agriculture, Swift Current (Saskatchewan).
D. R. Cameron, R. DeJong, and C. Chang.
Journal of Environmental Quality, Vol. 7, No. 4, p 545-550, October-December, 1978. 4 fig, 1 tab, 20 ref.

Descriptors: *Nitrogen removal, *Leaching, Nitrates, Denitrification, Fertilization, Tobacco, Beans, Potatoes.

Results from a 2-year study concerned with additions and losses of N from cropped fields in an intensively farmed sandy loam watershed in southern Ontario indicated that heavily fertilized burley tobacco (220 kg N/ha per year) and potato (165 kg N/ha per year) fields can potentially lose up to 52 and 92 kg N/ha per year, respectively, from the 75-cm profile by leaching and denitrification. Mineral M production rates calculated from results obtained in the field over the growing season varied from 0.0 to 0.73 kg N/ha per year. The lower rate resulted from leaching loses. The monitored NO3-N profile distributions under fertilized burley tobacco and potato crops showed definite leaching patterns. Soil water samples taken periodically from the potato field at 90 and 150 cm showed NO3-N moving through the lower profile in response to rainfall events. A plot treated with Cl showed no significant Cl leaching losses until early fall when rains moved about 45% of the added Cl below 75 cm. (Skogerboe-Colorado State)
W79-05819

SIMAZINE RESIDUE LEVELS IN IRRIGATION WATER AFTER DITCHBANK APPLICATION FOR WEED CONTROL,
Science and Education Administration, Denver, CO. Aquatic Weed Control Research Lab.
L. W. J. Anderson, J. C. Pringle, R. W. Raines, and D. A. Sisneros.
Journal of Environmental Quality, Vol. 7, No. 4, p 574-579, October-December, 1978. 8 fig, 2 tab, 20 ref.

Descriptors: *Aquatic weed control, Aquatic weeds, *Herbicides, *Irrigation water, Gas chromatography, Simazine.

A field study was conducted to determine the amount of simazine (2-chloro-4,6-bis (ethylamino)-s-triazine) likely to be found in irrigation water after ditchbank treatment for weed control. Resulting data are useful in evaluating the potential impact of simazine on crops irrigated from sprayed canals. Canals were selected in California, Colorado, and Washington for the application of simazine to both watered and dewatered sites at rates of 2.25 to 7.43 kg/ha. Simazine levels in flowing canal water immediately after herbicide application did not exceed 60 micrograms/liter. In first-flow samples collected in the spring from the sites that were dewatered at application, simazine levels peaked at about 250 micrograms/liter within the treated section but decreased rapidly to <5 micrograms/liter. (Skogerboe-Colorado State)
W79-05821

REDOX POTENTIALS IN A CROPPED POTATO PROCESSING WASTE WATER DISPOSAL FIELD WITH A DEEP WATER TABLE,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. H. Smith, R. G. Gilbert, and J. B. Miller.
Journal of Environmental Quality, Vol. 7, No. 4, p 571-574, October-December 1978. 2 fig, 2 tab, 9 ref.

Descriptors: *Oxidation-reduction potential, Waste water disposal, Denitrification, Nitrification, Nitrogen, Nitrates, Flood irrigation.

Redox potential measurements were made in a field irrigated with potato processing waste water at seven depths of 5 to 150 cm for 14 mo. Irrigation with canal water mixed with waste water in the summer, and with waste water in the winter, decreased redox potentials in the field at some depths for a short time but not enough to cause denitrification. However, as the soil temperature increased in the spring, and decomposition of the accumulated waste organic matter accelerated, redox potentials decreased after each irrigation at all observed depths. During April, redox potentials low enough to promote denitrification (below +225 mV) at 90-, 120-, and 150-cm depths in the soil persisted for 2 weeks. Irrigation with nondiluted waste water in June and July decreased redox potentials and denitrification occurred for up to 3 days after irrigations. As the soil temperature increased in the spring, nitrification of accumulated organic matter increased soil nitrates. Waste water irrigations from April to July promoted denitrification, removing most of the nitrate from the soil, and thereby decreasing the potential for groundwater pollution. (Skogerboe-Colorado State)
W79-05822

NITROGEN AND PHOSPHORUS LOSSES FROM ORGANIC SOILS,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy.
J. M. Duxbury, and J. H. Peverly.
Journal of Environmental Quality, Vol 7, No 4, p 566-570, October-December, 1978. 3 fig, 2 tab, 15 ref.

Descriptors: *Nutrient removal, Organic soils, Leaching, Nitrogen, Phosphorus, Drainage water.

The nutrient content of drainage water from Histosols located in New York was monitored from June 1975 through July 1977. Continuous flow records and nutrient concentration data obtained from daily composite samples were used to calculate annual nutrient outputs which ranged from 0.6 to 30.7 kg/ha for PO4(3)-P, 39.2 to 87.5 kg/ha for NO3(-)-N, and <1.0 to 1.9 kg/ha for NH4(+)-N. Nutrient concentrations in the drainage water increased with increasing flow, so that the greatest output of nutrients was during late winter and spring high-flow events. Maximum observed concentrations were 35 mg/liter for NO3(-) and 10 mg/liter for PO4(3-)-P. The amount of N lost in drainage water was similar at all sites and was about 10% of that mineralized; the remainder was presumed to be denitrified. The fiftyfold variability in phosphorus output appeared to be related to interactions within the soil profile rather than fertilizer practices, although these probably contributed to the generally high levels found. It was concluded that fertilizer nitrogen additions were unlikely to affect the quantity of NO3(-) leached. The study showed that organic soils can contribute to N and P in land runoff in much greater proportions than indicated by their area. (Skogerboe-Colorado State)
W79-05823

STREAM CHEMISTRY AND WATERSHED NUTRIENT ECONOMY FOLLOWING WILDFIRE AND FERTILIZATION IN EASTERN WASHINGTON,
Pacific Northwest Forest and Range Experiment Station, Wenatchee, WA. Forest Hydrology Lab.
A. R. Tiedemann, J. D. Helvey, and T. D. Anderson.
Journal of Environmental Quality, Vol. 7, No. 4, p 580-588, October-December, 1978. 2 fig, 7 tab, 49 ref.

Descriptors: *Streams, *Forest fires, Fertilization, Ureas, Ammonium compounds, Nutrients, Washington.

During the first three years after a severe wildfire in 1970, maximum concentrations of nitrate-N (NO3-N) in stream water increased from prefire levels of <0.016 to 0.56 mg/liter on a burned, unfertilized watershed and to 0.54 and 1.47 mg/liter on two watersheds that were burned and fertilized. Maximum NO3-N concentration in the stream from an unburned watershed was 0.066 mg/liter. Organic N concentrations in streamflow were nearly doubled during the second year after fire compared to prefire levels. Concentrations of total phosphorus in streams from one burned and two burned-fertilized watersheds were 1.5 to 3 times greater than from an unburned watershed. Combined concentrations of Ca, Mg, K, and Na in streams prior to fire ranged from 12.0 to 14.9 mg/liter. Concentrations declined to 7.4-10.5 mg/liter in streams from burned and burned-fertilized watersheds during the second year after fire (1972) because of dilution resulting from increased discharge and were still less in 1975 than prefire levels. Average inputs of N, P, and the four cations during the five years of study were 1.23, 0, and 3.56 kg/ha per year. Yearly N input from precipitation was sufficient to balance solution losses in three of the five postfire years. Cation losses in solution greatly exceeded precipitation inputs in all years. Results indicate that fire and fertilization exerted negligible effects on chemical water quality for municipal use. (Skogerboe-Colorado State)
W79-05824

GROUNDWATER POLLUTION. PART 2. POLLUTION FROM IRRIGATION AND FERTILIZATION. VOL. 2. 1977-JANUARY, 1978. (CITATIONS FROM THE NTIS DATA BASE),
National Technical Information Service, Springfield, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as NTIS/PS-78/0141, Price codes: N01 in paper copy, N01 in microfiche. February, 1978. R. J. Brown, Editor. 65 p.

Descriptors: *Abstracts, *Bibliographies, *Groundwater pollution, Irrigation, Fertilization.

The bibliography contains abstracts of Federally-funded research covering aspects of groundwater pollution from irrigation and fertilization. The reports include topics dealing with the pollution from sewage and waste water irrigation, land spreading of sludges and solid wastes, nitrate and phosphate accumulation in soils, pollution control and abatement planning, salt build-up from irrigation, the use of tile drains in groundwater pollution control, and groundwater recharge studies. (Skogerboe-Colorado State)
W79-05826

QUALITY OF SELECTED WATERS IN SOUTHERN MAINE.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality Control.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 729, Price codes: A03 in paper copy, A01 in microfiche. Report 1976. 47 p.

Descriptors: *Maine, *Water quality, *Data collections, Discharge(Water), Design, Design data, Monitoring, Evaluation, Planning, Sampling, Analysis, Phosphorus, Gaging stations, Gaging, Drainage, Tidal waters, Salinity, Water temperature, Dissolved oxygen, Dissolved solids, Coliforms, Heavy metals, Nitrogen.

The report is a compilation of water quality data determined from a number of water bodies in the southern Maine area. The data were accumulated pursuant to the continuing need of the Department of Environmental Protection (DEP) to develop background indications of existing water quality in the area. Guidance was accepted from the Southern Maine Regional Planning Commission (SMRPC) in the design of the monitoring program in order to meet the mutual needs of the organizations. The report is a continuation of similar efforts begun in 1975. Project management was provided by the DEP's Division of Water Quality Evaluation and Planning in conjunction with the SMRPC. Sample collection and analysis were performed by the Department's Division of Laboratory and Field Services. Water quality data were determined according to EPA guidelines promulgated in FR 38 (199), p. 28758. Exceptions are the total phosphorus and NO3+NO2-N determinations for which Department modifications were used. Discharge data in the Great Works River were provided by the USGS according to state-of-the-art techniques. Goosefare Brook discharge data were determined by the DEP. Discharge data were provided only at gaged stations, and extrapolation by drainage areas for calculated values at different stations was left to the reader. Time of Travel along the Great Works data was determined by the DEP according to USGS fluorometric techniques. Sample locations were described as completely as reasonably possible on individual data sheets. The description should allow the reader to find the exact location using a 15 minute USGS topographic map. Otherwise, maps showing sample stations are available in the DEP. (Froehlich-ISWS)
W79-05832

SURFACE WATER QUALITY ASSOCIATED WITH THE SURFACE MINING OF IOWA COAL,
Iowa State Univ., Ames. Energy and Mineral Resources Research Inst.
J. B. Gulliford, R. B. Wildman, and L. K. Payne.
Available from the National Technical Information Service, Springfield, VA 22161 as IS-ICP-55, Price codes: A03 in paper copy, A01 in microfiche. Report IS-ICP-55, November 7, 1977. 29 p, 7 fig, 5 tab, 3 ref, 1 append.

Descriptors: *Mining, *Acid mine water, *Mine acids, *Mine wastes, *Iowa, Strip mine wastes, Sediments, Chemicals, Pollutants, Sediment control, Water treatment, Water pollution, Water pollution sources, Water quality, Surface waters, On-site investigations, Coal mines, Coal mine wastes, Path of pollutants.

The production of acid mine drainage has long been a problem associated with the surface mining of coal, and typically high levels of sulfur in both coal and shale overburden make this problem particularly acute in Iowa. The Iowa Coal Project Demonstration Mine No. 1 was operated as a research mine to determine and examine the environmental problems associated with the surface mining of Iowa coal. A major problem identified during mining was that of available operating space. When the problem of acid mine drainage treatment accessibility was identified, the mining operation was without space to correct it. It was recommended that provision for expanding acid mine drainage treatment facilities be a part of all

mine plans. A well-organized haul-back mining plan also can provide the opportunity to reduce the acid mine drainage from a surface mine. By directing the surface runoff from the mine site around the active pit and into the sediment pond, less water is exposed to toxic shales to produce acid mine drainage. This diverted water will still carry a sediment load, but it will not require neutralization. It was recommended that any methods of reducing acid generation be utilized to reduce the cost and difficulty of water treatment. (Sims-ISWS)
W79-05834

DISPOSAL OF A LARGE QUANTITY OF SODIUM FLUOROACETATE IN A SANITARY LANDFILL SITE LOCATED IN AN AQUIFER RECHARGING AREA,
Jefferson County Health Department, Lakewood, CO.; and Colorado Univ., Denver. School of Medicine.
For primary bibliographic entry see Field 5G.
W79-05835

PARAMETER ESTIMATION OF STREETER-PHELPS MODELS,
Politecnico di Milano, Milan (Italy).
S. Rinaldi, P. Romano, and R. Soncini-Sessa.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE1, Proceedings Paper 14377, p 75-88, February 1979. 5 fig, 1 tab, 20 ref, 2 append.

Descriptors: *Water quality, *Water pollution, *Model studies, *Mathematical models, Biochemical oxygen demand, Dissolved oxygen, Oxygen, Rivers, Foreign countries, Foreign research, Pollutants, Measurement, Environment, Environmental engineering, Data processing, Analytical techniques, *Italy, *Bormida River(Italy), *Parameter estimation, Parameters.

A method for the estimation of the parameters of generalized Streeter-Phelps river quality models was developed in this paper. The method is quite flexible since it does not require any uniformity in the geometry of the measurement points and can be used in the case in which only DO data are available. The validity of the method was tested by means of real data collected on the Bormida river in northern Italy, and the corresponding results and difficulties were pointed out. Finally, the sensitivity of the method with respect to missing data was analyzed. (Sims-ISWS)
W79-05841

MONITORING AREAWIDE RURAL WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W79-05842

AN AUTOMATIC SEQUENTIAL RAIN SAMPLER,
Laboratoire de Chimie Inorganique et Nucleaire, Chemin du Cyclotron, Louvain (Belgium).
For primary bibliographic entry see Field 7B.
W79-05847

THE OCCURRENCE OF ORGANOCHLORINE RESIDUES IN RAINWATER,
Freshwater Fisheries Lab., Pitlochry (Scotland).
For primary bibliographic entry see Field 5A.
W79-05848

WET AND DRY DEPOSITION OF NUTRIENTS IN CENTRAL ALBERTA,
Alberta Univ., Edmonton.
R. Caiazza, K. D. Hage, and D. Gallup.
Water, Air, and Soil Pollution, Vol. 9, No. 3, p 309-314, April 1978. 1 fig, 4 tab, 5 ref.

Descriptors: *Fallout, *Nutrients, *Canada, *Water pollution sources, On-site investigations, Phosphates, Sulfates, Nitrogen, Iron, Sodium, Potassium, Rain water, Rain, Snow, Data collections, *Alberta(Canada).

Dry and wet deposition rates of various forms of phosphate and N and of Fe, sulphate, Na, K, and silica ions were reported for a 1 yr period in central Alberta. The results were extrapolated from event samples of rain and snow, and from dry deposition samples in distilled water collectors and snowpack. Following corrections for contamination and evaporation, the most reliable dry deposition rates were found for orthophosphate; organic and nitrate N; and Fe, sulphate, and K ions. Ion concentrations in snow were significantly lower than those in rain for ammonia, organic and total N, and for sulphate and silica ions. More than 50% of the concentrations of total phosphate and total N in wet deposition samples is dissolved or in fine particles (less than 0.45 micrometer), but ony about 1/3 of dry deposition sample concentrations is in such form. Dry-to-wet deposition ratios for the year exceed one for filtered total N, filtered total phosphate, Fe, and sulphate. The largest dry-to-wet deposition ratios are about 5 for sulphate and unfiltered total N. It seems clear that both wet and dry depositions of these nutrients are important for lakes in central Alberta. (Humphreys-ISWS)
W79-05849

DETECTION OF HEAVY METAL POLLUTION IN ESTUARINE SEDIMENTS,
Florida State Univ., Tallahassee. Dept. of Oceanography; and Florida State Univ., Tallahassee. Florida Resources and Environmental Analysis Center.
J. O. Pilotte, J. W. Winchester, and R. C. Glassen.
Water, Air, and Soil Pollution, Vol. 9, No. 3, p 363-368, April 1978. 1 fig, 2 tab, 4 ref.

Descriptors: *Heavy metals, *Pollutants, *Estuaries, *Florida, Sediments, Estuarine environment, Water pollution sources, Surveys, Nickel, Lead, Iron, Copper, Data collectons, Potassium, Chromium, Manganese, Zirconium, Rubidium.

Anomalies in the concentrations of heavy metals in estuarine sediments may not be reliably detected based on the measured concentration values or the ratios of metal concentrations to those of a reference element because of natural variations in both. However, the departure of a measurement from a regression line between metal and reference element concentrations may serve as a criterion for detecting an anomaly. The procedure has been applied to a suite of 34 sediments from the Bayou Chico, a Florida estuary. As a group, the buried sediment samples showed greater variability in composition relative to Rb than did the surface sediment samples; the reasons may be geochemical unrelated to pollution, and anomalies may include both low and high concentrations. A comparison of each metal concentration with that of Rb selected as a reference element by means of a regression equation was valuable in identifying the presence or absence of anomalous heavy metal concentrations. (Humphreys-ISWS)
W79-05850

TRACE METAL TRANSPORT FROM MINING, MILLING, AND SMELTING WATERSHEDS,
Syracuse Univ., NY.
J. C. Jennett, and J. L. Foil.
Journal of the Water Pollution Control Federation, Vol. 51, No. 2, p 378-404, 1979. 10 fig, 9 tab, 42 ref.

Descriptors: *Water pollution, *Heavy metals, *Mining, *Path of pollutants, *Missouri, Pollutants, Water pollution sources, Mine wastes, Lead, Zinc, Copper, Cadmium, Manganese, Sediments, Suspended solids, Sediment transport, Streams, Runoff, Precipitation(Atmospheric), Watersheds(Basins), Sampling, Chemical analysis, Milling wastes, Smelting wastes.

The world's newest and largest lead-zinc mining district is known as the 'New Lead Belt' of 'Viburnum Trend' of southeast Missouri; within the past decade, the region has become the producer of 80% of the lead needed in the U.S. Because the district is located almost entirely within the boundaries of Clark National Forest, one of Missouri's most undisturbed wilderness areas, and because the area abounds in wild, unpolluted, and uninhabited stream basins, the area has become a laboratory for the study of lead and zinc in the aquatic environment. This study took advantage of this natural region to evaluate the effects of the new, large lead and zinc mining, milling, and smelting operations on the chemical and physical quality of the aquatic environment. It was found that under normal non-runoff conditions, the receiving stream physical and chemical water quality below the mining, milling, and smelting operations of the New Lead Belt is not radically different from that of the control streams in the region. The only significant difference is that turbidity and suspended solids levels were slightly higher in receiving streams and that heavy metals were found to be associated with the solids. The primary reason for these streams being unaffected by the mining and milling operations seems to be that the receiving streams have a relatively basic pH and a relatively high carbonate content. This causes any metal that escapes the operation to be precipitated rapidly as a finely divided particle. These particles may either fall to the sediments or be carried with the normal stream flow. (Sims-ISWS)
W79-05858

QUANTITATIVE ANALYSIS OF AIRCRAFT MULTISPECTRAL-SCANNER DATA AND MAPPING OF WATER-QUALITY PARAMETERS IN THE JAMES RIVER IN VIRGINIA,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
For primary bibliographic entry see Field 7B.
W79-05862

TECHNOLOGY AND ECONOMICS OF INDUSTRIAL POLLUTION ABATEMENT,
Illinois Inst. for Environmental Quality, Chicago.
J. W. Patterson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 338, Price codes: A99 in paper copy, A01 in microfiche. Report No. IIEQ, October 1976. 620 p, 97 fig, 156 tab, 948 ref. 20.070 A.

Descriptors: *Pollutant identification, *Water pollution sources, *Water pollution treatment, *Waste water treatment, *industrial wastes, Costs, Economics, Arsenic compounds, Cadmium, Chromium, Copper, Fluorides, Iron, Lead, Manganese, Mercury, Nickel, Nitrogen, Ammonia, Nitrates, Oil wastes, Phenols, Selenium, Dissolved solids, Zinc.

Information on 23 water pollutants regulated by the state of Illinois is presented. Each pollutant is discussed in a separate chapter in which industrial sources are identified and typical levels of the pollutant are discussed. Available treatment technology for the specific pollutant is described with regard to the operational method of the technology, its limitations, the treatment levels which have been accomplished in the application of that technology, and the economics of each technology. (Davison-IPA)
W79-05865

LEACHING OF CATIONS AND CHLORIDE FROM MANURE APPLIED TO AN IRRIGATED SOIL,
California Univ., Riverside. Dept. of Soil and Environmental Science.
P. F. Pratt.
Journal of Environmental Quality, Vol 7, No 4, p 513-516, October-December, 1978. 3 fig, 15 ref.

Descriptors: Leachate, *Leaching, Organic wastes, *Cations, Chlorides, *Irrigation.

Data for leached cations, (the sum of Ca(2+), Mg(2+), Na(+), and K(+)), and leached Cl(-) and the ratio of cations to Cl(-) leached from the root zone during a 4-year experiment with bovine manures on a Hanford soil were presented. Cation accumulation in the soil and the cations leached were linearly correlated with cation input. The

removal of cations in harvested crops reached a maximum and then decreased as the input of cations increased. Leached Cl(-) increased at a ratio of 1:1 with the Cl(-) input in excess of removal in harvested crops, whereas leached cations increased with increase in inputs in excess of removal in crops and decreased with decrease in the volume of leachate. At low leachate volumes and with dry weights of liquid and solid manures at 21 and 40 metric tons/ha per year, respectively, the cations leached were less than in the check plots. At high leachate volumes manures increased the cations leached relative to the check treatment at all rates of manure. The dominant factor in cation leaching was volume of leachate. Carefully controlled irrigation to attain low leachate volumes combined with manure applications at reasonable rates could be used to reduce the overall effect of irrigation on the leaching of salts to groundwaters. (Skogerboe-Colorado State)
W79-05931

TRANSPORT OF ANTIBIOTIC-RESISTANT ESCHERICHIA COLI THROUGH WESTERN OREGON HILLSLOPE SOILS UNDER CONDITIONS OF SATURATED FLOW,
Oregon State Univ., Corvallis. Dept. of Soil Science; and Oregon State Univ., Corvallis. Dept. of Microbiology.
T. M. Rahe, C. Hagedorn, E. L. McCoy, and G. F. Kling.
Journal of Environmental Quality, Vol. 7, No. 4, p 487-494, October-December, 1978. 3 fig, 3 tab, 16 ref.

Descriptors: Sewage effluents, *Coliforms, Groundwater, Tracers, *Septic tanks, Sewage disposal, Perched water, Subsurface flow.

Field experiments using strains of antibiotic resistant Escherichia coli were conducted to evaluate the events which would occur when a septic-tank drainfield became submerged in a perched water table and fecal bacteria were subsequently released into the groundwater. Three separately distinguishable bacterial strains were inoculated into three horizontal lines installed in the A, B, and C horizons of two western Oregon hillslope soils. Movement was evaluated by collecting groundwater samples from rows of modified piezometers (six piezometers/row) placed at various depths and distances downslope from the injection lines. Transport of E. coli differed at both sites with respect to movement rates, zones in the soil profiles through which major translocation occurred, and the relative numbers of cells transported over time. Movement rates of at least 1,500 cm/hour were observed in the B horizon at one site. The strains of E. coli survived in large numbers in the soils examined for at least 96 hours and appeared to be satisfactory as tracers of subsurface water flow. The concept of partial displacement (or turbulent flow through macropores) was discussed as an explanation of the rapid movement of substantial numbers of microbial cells through saturated profiles. (Skogerboe-Colorado State)
W79-05932

BIOLOGICAL HYDROLYSIS OF PARATHION IN NATURAL ECOSYSTEMS,
Central Rice Research Inst., Cuttack (India). Lab. of Soil Microbiology.
B. Sudhakar, and N. Sethunathan.
Journal of Environmental Quality, Vol. 7, No. 3, p. 346-348, July-September, 1978. 5 tab, 11 ref.

Descriptors: *Organophosphorus compounds, *Flooding, Hydrolysis, *Parathion, *Hydrolysis.

Parathion (0,0-diethyl 0,p-nitrophenyl phosphorothioate) was applied to flooded soils and to water and sediment river, lake, and pond samples at 15-day intervals. While p-nitrophenol (0,0-dimethyl 0,p-nitrophenyl phosphorothioate), the hydrolysis product of parathion, was not detected, even at the end of 12 days after the first addition, it was detected in all samples within 6 hours after two or three additions of the insecticide. Enrichment cultures from the samples of different ecosystems lost their ability to hydrolyze parathion following autoclaving, suggesting microbial participation in parathion hydrolysis. (Skogerboe-Colorado State)
W79-05935

PRECIPITATION AND THROUGHFALL CHEMISTRY IN THE SAN FRANCISCO BAY AREA,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
J. G. McColl, and D. S. Bush.
Journal of Environmental Quality, Vol. 7, No. 3, p 352-357, July-September, 1978. 3 fig, 1 tab, 36 ref.

Descriptors: *Precipitation(Atmospheric), Throughfall, Rainfall, Chemical analysis, Forest soils, *Air pollution, Nutrients, California.

At Berkeley, California, main ionic constituents of bulk precipitation during the wet season of 1974-1975 were SO4(2-), Cl(-), HCO3(-), Na(+), and Ca(2+), and mean H(+) concentration was 10.7 + or - 1.5 microequivalents/liter (pH 5.0). Although SO4(2-) comprised 50% of the anions in bulk precipitation, H(+) concentration had the highest correlation with NO3(-). Impacted air pollutants accumulated on tree leaves between major rainstorms. Atmospheric N and S were correlated with NO3(-) and SO4(2-) in bulk precipitation resembled that of surface-soil solution in an adjoining, recently clear-cut area. (Skogerboe-Colorado State)
W79-05937

TIMING AND RATE OF FERTILIZER NITROGEN FOR SUGARBEETS RELATED TO NITROGEN UPTAKE AND POLLUTION POTENTIAL,
California Univ., Davis. Dept. of Soil Microbiology.
F. J. Hills, F. E. Broadbent, and M. Fried.
Journal of Environmental Quality, Vol. 7, No. 3, p 368-372, July-September, 1978. 4 fig, 3 tab, 11 ref.

Descriptors: *Nitrogen, Fertilization, Nutrient requirements, *Sugar beets, Crop production, Tracers.

Nitrogen (N) uptake by sugarbeets (Beta vulgaris L.) from fertilizer and soil, as related to time and rate of application, was evaluated at Davis, California, in two field experiments utilizing 15N-deleted ammonium sulfate. There were no significant differences in root, top, or sugar yield when fertilizer N (135 kg/ha) was applied at planting, at thinning, split equally between thinning and layby, or split equally between planting, thinning, and layby. Also, there were no substantial differences in soil or fertilizer N in tops and roots in response to these dates of application. Fertilizer N recovery was 47% when 112 kg N/ha were applied to achieve maximum sugar yield. Roots removed as much N as that applied and tops contained an additional 105 kg N/ha. When applied N was 2.5 times the amount required for maximum sugar yield, tops and roots contained almost as much N as applied. The sugarbeet crop, carefully fertilized, has potential for alleviation of nitrate pollution of groundwater. (Skogerboe-Colorado State)
W79-05939

EFFECTS OF SO2 AND NO2 ON NITRIFICATION IN SOIL,
Abbott Lab., North Chicago, IL.
D. Labeda, and M. Alexander.
Journal of Environmental Quality, Vol 7, No 4, p 523-526, October-December, 1978. 4 fig, 1 tab, 24 ref.

Descriptors: Air pollution, *Nitrification, Nitrates, *Fumigants, Nitrites, Ecology, Soil chemistry, *Sulfur dioxide.

Nitrification in Lima loam, pH 7.2, was not affected by continuous exposure of the soil to 0.5 ppm of SO2 or to brief exposures to higher SO2 levels. Such treatment did not increase the levels of soluble K, Mg, Ca, Mn, Fe, and Al. Intermittent exposure of Hudson silty clay loam, pH 5.0, to SO2 reduced the rate of nitrate formation. Continuous fumigation of the acid soil with 10 ppm of SO2 decreased the rate of nitrification, and continuous fumigation with as little as 1.0 ppm increased the quantity of soluble Mn and Fe. Continuous fumigation of Lima loam with 5 ppm NO2 inhibited the rate of ammonium disappearance, led to greater rates of nitrate formation, and resulted in nitrite accumulation. Nitrite at a level of 30 micrograms/Ng of soil also reduced the rate of ammonium disappearance. The results demonstrated that nitrification in certain soils could be inhibited in areas acutely polluted with SO2 and NO2. (Skogerboe-Colorado State)
W79-05940

GROWTH AND ELEMENTAL COMPOSITION OF CORN AND BEAN SEEDLINGS AS INFLUENCED BY SOIL APPLICATION OF COAL ASH,
Savannah River Ecology Lab., Aiken, SC.
D. C. Adriano, T. A. Woodford, and T. G. Ciravolo.
Journal of Environmental Quality, Vol 7, No 3, p 416-421, July-September, 1978. 5 tab, 43 ref.

Descriptors: *Coal mine wastes, Corn, Beans, Crop production, Soil chemical properties, Fossil fuels, *Fly ash, Toxicity, Salinity, Deficient elements.

Analyses of 0.1N HCl extracts of ash (slag + fly ash) samples from bituminous coal revealed high concentrations of K, Ca, and Fe and intermediate concentrations of P, Mg, Cu, Mn, and Zn. Of the elements analyzed, the extractable concentrations increased as particle size decreased from > 1,000 micron to < 105 micron. The slightly acidic ashes were mixed with Troup sandy loam at rates of 5, 10, and 20% by weight and equilibrated in a glasshouse for 1 mo before planting. 'Coarse' ash was used at only the 10% rate. Corn and bush bean yields from ash-amended soils were statistically equal to yields from a control treatment but significantly lower than fertilized treatment. Corn exhibited P deficiency symptoms while symptoms characteristic of B toxicity occurred in beans. Analyses of tissues of both crops indicated that P concentrations were at deficiency levels while Cu, Mn, and Zn were deficient to marginal. Iron, however, appeared to be in the normal range. Salinity as indicated by EC of leachate of 3 mmhos/cm or greater, B excess as indicated by the toxicity symptoms in beans, and P deficiency as indicated by low P concentrations in plant tissues could limit crop growth in ash-treated soils. (Skogerboe-Colorado State)
W79-05942

THE UPTAKE OF 203HG-LABELED MERCURY COMPOUNDS BY BROMEGRASS FROM IRRIGATED UNDISTURBED SOIL COLUMNS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
T. J. Hogg, J. R. Bettany, and J. W. B. Stewart.
Journal of Environmental Quality, Vol 7, No 3, p 445-450, July-September, 1978. 1 fig, 8 tab, 17 ref.

Descriptors: *Mercury, *Sewage effluent, Sewage disposal, Environmental effects, *Bromegrass, Irrigation, Leachate, Organic matter.

Bromegrass (Bromus inermis) was grown under conditions of sewage effluent irrigation on undisturbed soil columns in which the 0- to 10-cm layers had been treated with 10 micrograms Hg/g soil as 203Hg-labeled mercuric chloride (HgCl2), phenyl mercuric acetate (PMA), and methyl mercuric chloride (MMC). Mercury concentrations in plant dry matter decreased over three successive harvests and highest values were found on MMC-treated soils of fine texture and low organic matter content (2.0 to 0.2 micrograms Hg/g for first and third harvest, respectively). Exposure of the plants and soils to simulated fall conditions resulted in a small but significant increase in the Hg concentration of plant dry matter. Higher levels of Hg were found in plant stems than plant foliage at the termination of the experiment and even higher levels in the main roots and fine roots separated

from the 0-10 cm soil layer. Mercury concentration of roots decreased with depth for all Hg treatments, but were still 150 times greater than background levels in the MMC-treated soils at the 40- to 60-cm depth. A significant amount of all forms of applied Hg (10-32%) was lost during the experiment, presumably by volatilization. The majority of the remaining Hg in the soil was found to be strongly bound and not extractable by weak salt solutions, dilute acids, and chelates. (Skogerboe-Colorado State)
W79-05943

INFLUENCE OF THE CHEMICAL FORM OF MERCURY ON ITS ADSORPTION AND ABILITY TO LEACH THROUGH SOILS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
T. J. Hogg, J. W. B. Stewart, and J. R. Bettany.
Journal of Environmental Quality, Vol 7, No 3, p 440-445, July-September, 1978. 2 fig, 4 tab, 19 ref.

Descriptors: *Mercury, *Adsorption, *Leaching, Volatility, Sewage effluents, Sewage disposal, Soil analysis.

The adsorption of Hg by two soils, differing in chemical and physical characteristics, indicated that methyl mercuric chloride (MMC), phenyl mercuric acetate (PMA) and mercuric chloride (HgCl2) followed the linear form of the Langmuir adsorption isotherm. The highest adsorption maxima for all Hg compounds were found for the soils which had the higher organic matter content and clay content. Adsorption maxima increased in the order MMC < PMA < HgCl2. A two-rate effluent leaching experiment was conducted utilizing undisturbed soil cores of the same two soils and the same three Hg compounds (labeled with 203Hg) which were applied uniformly to the top 0-10 cm of each column. In contrast to the movement of other cations in the effluent and soil, even at the higher irrigation rate, none of the applied Hg was found to move below the 10- to 20-cm soil layer. The lack of movement of Hg and the high adsorption maxima was a consequence of the strong binding between Hg compounds and soil. The inability of weak chemical extractants (CaCl2, NH4OAC, DTPA, EDTA) to remove significant quantities of Hg confirmed this hypothesis. Seven to 31% of the applied Hg was lost from the columns during the experiment presumably by volatilization. (Skogerboe-Colorado State)
W79-05944

EFFECT OF SEPTIC TANK EFFLUENT ON THE BASE STATUS OF TWO TILE-DRAINED SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
R. B. Reneau, Jr., W. F. Kitchell, and C. D. Peacock, Jr.
Soil Science, Vol 127, No 2, p 117-126, February 1979. 9 fig, 2 tab, 11 ref.

Descriptors: *Sewage effluents, *Septic tanks, *Soil water, *Groundwater, Soils, Soil types, Chemicals, Chemical analysis, Sodium, Calcium, Magnesium, Potassium, Water levels, Water supply, Effects, Water pollution, Water pollution effects, Pollutants, Path of pollutants, Drainage, Tile drainage, Water quality, Water chemistry.

Changes in SAR (sodium adsorption ratio), pH, and EC (electrical conductivity) of shallow groundwaters as a result of disposal of septic tank effluents into wet-tile-drained soils (Typic and Aeric Ochraqualts) were studied during 1974, 1975, and 1976. Changes in these constituents in groundwaters were monitored at selected distances from the drainfield (by placement of sampling wells in the direction of groundwater flow) in waters intercepted by the agricultural tile, and control wells. Sodium adsorption ratio, pH, and EC generally decreased with increasing distance from the disposal area. The SAR decreased from 20 to 25 in samples adjacent to the drainfield to less than 2 in the control wells. The SAR in the drinking water supply was 40. Soil samples were collected to the 160-cm depth at distances corresponding to the location of water-table wells. Changes in ESP (exchangeable sodium percentage), BS (base saturation), and pH occurred in both the Typic and Aeric Ochraqualts and reflected changes detected in groundwater samples. Increased ESP, BS, and pH were observed adjacent to the disposal area in the argillic horizons when compared to the surface horizons. Values for these constituents in the argillic horizon decreased with increased sampling distance from the disposal area. In the control profile, their distribution was reversed, the surface horizon normally having increased ESP, BS, and pH compared to the subsurface horizons. (Sims-ISWS)
W79-05945

EXTRACTABILITY OF CADMIUM, COPPER, NICKEL, AND ZINC BY DOUBLE ACID VERSUS DTPA AND PLANT CONTENT AT EXCESSIVE SOIL LEVELS,
Science and Education Administration, Beltsville. Fruit Lab.
R. F. Korcak, and D. S. Fanning.
Journal of Environmental Quality, Vol 7, No 4, p 506-512, October-December, 1978. 1 fig, 9 tab, 18 ref.

Descriptors: Trace elements, *Heavy metals, Corn, *Sewage sludge, Correlation analysis, Cadmium, Copper, Nickel, Zinc.

Cadmium, copper, nickel, and zinc were applied as sulfate salts to samples of surface horizons of three Maryland soils in the greenhouse at rates of metals equivalent to those in 0 to 896 dry metric tons/ha of Washington, D.C., digested sewage sludge. The sludge was also applied at a rate of 224 dry metric tons/ha. Two pH regimes, approximately 5.5 and 6.5, were maintained. Metals were extracted by the DTPA (diethylenetriaminepentaacetic acid buffered at pH 7.3) or double acid (0.05N HCl, 0.025N H2SO4) extractants. Correlations were determined between extractable soil metals and metal content of two crops of corn (Zea mays L.) each grown for 30 days, but at times of 1 or 13 mo after making the chemical amendments to the soils. The results of the experiments were reported. (Skogerboe-Colorado State)
W79-05946

ZINC AND CADMIUM CONTENTS OF AGRICULTURAL SOILS AND CORN IN NORTHWESTERN INDIANA,
Metropolitan Sanitary District of Greater Chicago, IL. Research and Development Lab.
R. I. Pietz, R. J. Vetter, D. Masarik, and W. W. McFee.
Journal of Environmental Quality, Vol. 7, No. 3, p 381-385, July-September, 1978. 1 fig, 3 tab, 26 ref.

Descriptors: *Heavy metals, *Soil contamination, Environmental effects, Crop response, Zinc, Cadmium, Industrial plants, Urbanization, Corn.

Soil and corn (Zea mays L.) leaf and grain samplings were conducted in northwestern Indiana to determine if airborne heavy metal particulates containing Cd and Zn from the northwestern Indiana industrial-urban complex, situated on the south side of Lake Michigan, were contaminating soils and crops. Sampling in the region revealed no widespread metal contamination. Some metal enrichment had occurred on agricultural soils in Gary and East Gary, Indiana. Corn leaf concentrations of Cd, Pb, and Zn fluctuated with sampling location, but grain Cd and Pb levels remained essentially constant at < 0.05 and < 0.4 microgram/gram, respectively. A comparison of Zn/Cd ratios in soils, and in corn leaves and grain, suggested that Cd was more actively accumulated in the corn plant but not the grain. Because of the limited acreage affected and the relatively low metal levels observed, no human or animal health problems are expected from harvested crops or silage. The use of log distance vs. log metal concentration in regression analysis showed that the limited metal contamination of agricultural soils was mainly in a southeasterly direction from the industrial-urban area. (Skogerboe-Colorado State)
W79-05947

CHEMICAL, PHYSICAL, BIOCHEMICAL, AND BACTERIOLOGICAL CHARACTERISTICS AT SELECTED STREAM SITES IN PUERTO RICO, 1967-77,
Geological Survey, San Juan, PR. Water Resources Div.
For primary bibliographic entry see Field 7A.
W79-05967

INSTALLATION OF WATER- AND GAS-SAMPLING WELLS IN LOW-LEVEL RADIOACTIVE-WASTE BURIAL TRENCHES, WEST VALLEY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
D. E. Prudic.
Geological Survey open-file report 78-718, 1978. 70 p, 22 fig, 3 tab, 5 ref.

Descriptors: *Water analysis, *Radioactive waste disposal, *Sites, *Sampling, Gases, Wells, Trenches, Analytical techniques, Water pollution, New York, Hand-augered wells, *West Valley(NY), *Cattaraugus County(NY), Radioactive-waste burial.

A low-level radioactive-waste burial site, West Valley, N.Y., operated from 1963 to 1975, contains 12 refuse-filled trenches about 20 feet deep in till. Twenty-eight wells, 1.25 inch in diameter, were driven to selected depths in 11 of the 12 trenches to obtain gas and water samples for chemical and radiochemical analysis, water-level measurements for evaluation of trench-cover permeability. Gas from unsaturated refuse above the trench water level was detected in nearly all wells. Rapid water-level response in most wells to pumping of water from trench sumps 20 to 275 feet distant showed the refuse to be highly permeable. Described in detail are the methods and equipment used to (1) install the wells, (2) collect gas and water samples, and (3) monitor radiation and methane concentrations while driving wells into trenches. A record of each well driven into the burial trenches is included. (Woodard-USGS)
W79-05970

GROUND-WATER QUALITY NEAR THE NORTHWEST 58TH STREET SOLID-WASTE DISPOSAL FACILITY, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. C. Mattraw, J. E. Hull, and H. Klein.
Geological Survey Water-Resources Investigations 78-45, April 1978. 61 p, 28 fig, 10 tab, 16 ref.

Descriptors: *Landfills, *Solid wastes, *Leaching, *Path of pollutants, *Aquifer characteristics, Water quality, Leachate, Movement, Diffusion, Dispersion, Advection, Convection, Waste dilution, Rainfall, Infiltration, Florida, *Dade County, *Biscayne aquifer.

The Northwest 58th Street solid-waste disposal facility, 3 miles west of a major Dade County municipal water-supply well field, overlays the Biscayne aquifer, a permeable, solution-riddled limestone which transmits leachates eastward at a calculated rate of 2.9 feet per day. A discrete, identifiable leachate plume has been recognized under and downgradient from the waste disposal facility. Concentrations of sodium, ammonia, and dissolved solids decreased with depth beneath the disposal area and downgradient in response to an advective and convective dispersion. At a distance of about one-half downgradient, the rate of contribution of leachate from the source to the leading edge of the plume was about equal to the rate of loss of leachate from the leading edge of the plume by diffusion and dilution by rainfall infiltration during the period August 1973 - July 1975. Heavy metals and pesticides are filtered, adsorbed by aquifer materials, or are precipitated near the disposal area. (Woodard-USGS)
W79-05972

MODELING NITROGEN, OXYGEN, CHATTAHOOCHEE RIVER, GA.,

Geological Survey, NSTL Station, MS. Water Resources Div.
J. E. Miller, and M. E. Jennings.
Preprint 3373 Presented at American Society of Civil Engineers Annual Meeting and Exposition, Chicago, Illinois, October 16-20, 1978. 18 p, 6 fig, 1 tab, 6 ref.

Descriptors: *Water quality, *Streams, *Model studies, *Nitrogen, *Dissolved oxygen, Analytical techniques, Flow control, Streamflow, Channel morphology, Effluents, Evaluation, Georgia, *Chattahoochee River, *Atlanta area.

During 1976 to 1977, the U.S. Geological Survey compiled four comprehensive sets of data, including streamflow, cross-section geometry, water quality, and waste effluent for a 67-mile reach of the upper Chattahoochee River near Atlanta, Ga. Using this data, steady and unsteady-state dissolved oxygen (DO) and nitrogen models were developed. Because reservoir releases from an upstream power reservoir were held to a fairly constant flow, the data form an excellent test case for steady-state dissolved oxygen and nitrogen model verification. The river was modeled utilizing all four data sets to calibrate and verify the USGS steady-state water-quality model (D. P. Bauer, M. E. Jennings, and J. E. Miller, written commun., 1978). A continuous record of DO was available from a DO monitor and some additional water-quality data for an unsteady flow period following a steady flow period was available from a DO monitor and some additional water-quality data for an unsteady flow period following a steady flow period was available within the reach; therefore, an unsteady-state model calculation (using parameters determined from the steady-state case but with rapidly varying streamflows) was run for comparison. The unsteady-state model used was developed by J. P. Bennett (written commun., 1978). (Woodard-USGS)
W79-05974

EFFECTS OF LAND USE AND WATER MANAGEMENT ON WATER QUALITY IN THE WESTERN SOUTH NEW RIVER CANAL BASIN, SOUTHEAST FLORIDA, 1974-75,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4C.
W79-05978

5C. Effects Of Pollution

KINETIC PARAMETERS OF THE CONVERSION OF METHANE PRECURSORS TO METHANE IN A HYPEREUTROPHIC LAKE SEDIMENT,
Michigan State Univ., East Lansing. Dept. of Microbiology.
R. F. Strayer, and J. M. Tiedje.
Applied and Environmental Microbiology, Vol. 36, No. 2, August 1978, p 330-340. 8 fig, 5 tab, 32 ref. NSF DEB 7606884.

Descriptors: *Kinetics, *Eutrophication, *Methane, *Hydrogen, *Acetate, *Wintergreen Lake(MI), *Sediments, *Michaelis-Menten equations, Michigan, Anaerobic conditions, Microorganisms Lakes, Carbon dioxide, Tracers, Degradation(Decomposition), Carbon, Cycling nutrients, Nutrients, Formate.

The kinetic parameters K sub m (Michaelis-Menten constant), maximal velocity (V sub max), turnover time (T sub t), and natural velocity (v) were determined for hydrogen and acetate conversion to methane by microflora of anaerobic pelagic sediments in hypereutrophic Wintergreen Lake, Michigan, using short-term methods (a few hours) and incubation temperature of 10-14 C. K sub m estimates for both hydrogen consumption and conversion of hydrogen to methane by sediment microflora averaged 0.024 micromols/g dry sediment. V sub max averaged 4.8 micromols H2/g/hr for hydrogen consumption and 0.64 micromol CH4/g/hr for conversion of hydrogen to methane during winter. Use of the Michaelis-Menten equation and estimates of K sub m, V sub max, and dissolved oxygen concentration to estimate natural rates of hydrogen consumption and conversion to methane indicated methane may not be the only fate of hydrogen in the sediment. Of several potential hydrogen donors, only formate stimulated sediment methanogenesis. Formate conversion to methane was so rapid that it was impossible to accurately estimate kinetic parameters. Acetate apparently was being converted to methane at or near the maximal rate with sediments collected in summer. Preincubation of sediment with hydrogen had a pronounced effect of kinetic parameters for acetate to methane conversion. (Lynch-Wisconsin)
W79-05508

MAJOR PASSAGE PROBLEMS,
National Marine Fisheries Service, Seattle, WA.
W. J. Ebel.
In: Columbia River Salmon and Steelhead, Schweibert, E., (Ed.). Proceedings of a Symposium, Vancouver, Washington, March 5-6, 1976. American Fisheries Society, Bethesda, MD 1977 p 33-39. 2 fig.

Descriptors: *Environmental effects, *Fish passages, Dams, Trout, Chinook salmon, Rivers, Snake River, Columbia River, Mortality.

This paper discusses the problems of survival of steelhead trout and chinook salmon stocks in the upper Snake River and the effect which the construction of dams along the Snake and Columbia Rivers has on this survival. Since 1969 adult return percentages of both species have declined at an alarming rate. This drop reflects losses of juveniles due to fish passage problems. The majority of these losses are attributed to turbines, supersaturation of water with nitrogen, delay in migration caused by impoundments, and an increase in predation. The average turbine mortality among migrating smolts is between 10 and 15%. Diversion screens have been developed and refined to the point where they are workable and can be used to divert fish from turbines adequately but future research will be centered on obtaining an optimum system. A collection and transport system is being investigated to determine the effects of transportation on homing and survival of juveniles. The data indicate that this system has been helpful in increasing the survival of both chinook and steelhead. (Chilton-ORNL)
W79-05509

CORPS OF ENGINEERS RESPONSIBILITIES AND ACTIONS TO MAINTAIN COLUMBIA BASIN ANADROMOUS FISH RUNS,
Army Engineer District, Portland, OR. North Pacific Div.
E. M. Mains.
In: Columbia River Salmon and Steelhead, Schweibert, E., (Ed.). Proceedings of a Symposium, Vancouver, Washington, March 5-6, 1976. American Fisheries Society, Bethesda, MD., 1977. p 40-43.

Descriptors: *Environmental effects, *Fish passages, Trout, Chinook salmon, Research priorities, Columbia River, U.S. Army Corps of Engineers.

The Fish and Wildlife Coordination Act requires that the Corps of Engineers coordinate its water resource activities with the federal and state fish and wildlife agencies. Over the past 25 years, the Corps has funded a Fisheries-Engineering Research Program to collect information for use in construction and operation of fish facilities and projects. Research has identified primary problem areas as the loss of juvenile fish - in turbines, from water supersaturated with atmospheric gases in the spillways, increased predation, and perhaps the loss of migratory motivation due to impoundments. Spillway deflectors have been developed and installed to eliminate the problem of supersaturation with gases. A transport system has been developed. Future programs are aimed at providing assistance to fish runs of the Snake River drainage. (Chilton-ORNL)
W79-05510

THE MID-COLUMBIA PUBLIC UTILITY RESPONSIBILITY,
Chelan County Public Utility District No. 1, Wenatchee, WA.
B. Leman.
In: Columbia River Salmon and Steelhead, Schweibert, E., (Ed.). Proceedings of a Symposium, Vancouver, Washington, March 5-6, 1976. American Fisheries Society, Bethesda, MD., 1977. p 44-50, 3 fig, 2 tab.

Descriptors: *Environmental effects, *Fish passages, Fish migration, Trout, Chinook salmon, Fish, Dams, Columbia River, Snake River.

The two principal factors in the fish passage problem in the Columbia watershed are identified as supersaturated gas in the river spillage downstream of dams, and turbine mortality to downstream migrants. The Northwest Utilities Combine sponsored research which indicated that fish retained in a free-volition cage in a reservoir suffered no mortality in 20 days, while exposed to gas concentrations of 119 to 128% saturation. It was also found that 90% of the live test specimens exhibiting extreme gas-bubble disease symptoms, after being held at depths of one meter or less, recovered in a cage placed at a depth of 3-4 meters. Descaling of fish from impingement on traveling intake screens and dermal abrasions from bypass system walls present serious problems. It is stated that spilling water during downstream migration has been verified as a workable means of passing migrants downstream. The problem with this method is the critical shortage of energy to meet the existing peak demand. Field studies toward the solution of these problems are underway. (Chilton-ORNL)
W79-05511

THE IMPORTANCE OF WATER QUALITY TO COLUMBIA RIVER SALMON AND STEELHEAD,
Corvallis Environmental Research Lab., OR.
G. R. Bouck.
In: Columbia River Salmon and Steelhead, Schweibert, E., (Ed.). Proceedings of a Symposium, Vancouver, Washington March 5-6, 1976. American Fisheries Society, Bethesda, MD., 1977. p 149-154, 15 ref.

Descriptors: *Water quality, *Environmental effects, Columbia River, Fish, Trout, Chinook salmon, Temperature, Heavy metals, Gases, Water quality standards.

In this discussion of the importance of water quality it is pointed out that no other single parameter has such a determining effect on a fishery as does water temperature. Temperature has a major impact on metabolic rates so that increased temperatures can result in increased weight loss during migration. Metabolic wear and tear caused by high temperature also has an adverse effect on primary sexual development in sockeye salmon. Juvenile salmon and steelhead have difficulty making the parr-smolt transformation at temperatures above 13C. Heavy metals are mined at several locations in the Columbia River basin and the toxic effects of these are discussed. Nitrogen supersaturation which was reported elsewhere in the symposium is touched upon. (Chilton-ORNL)
W79-05512

WORKSHOP ON COPPER IN ESTUARINE, CONTINENTAL AND MARINE WATERS,
Available from the National Technical Information Service, Springfield, VA 22161 as CONF 771236, Price codes: A03 in paper copy, A01 in microfiche. CONF-771236. Proceedings of a Workshop December 7-8, 1977. San Francisco, California, April 1978 36 p.

Descriptors: *Conferences, *Environmental effects, *Copper, Aquatic environment, Estuarine environment, Sea water.

This publication is the summary of a workshop which was held following the fall meeting of the American Geophysical Union, 1977. The purpose of the workshop was to discuss the state of knowl-

edge, evaluate present research, and to provide emphasis for future direction of research on the subject of the workshop. The workshop consisted of four major topic areas (Analytical and Sampling Techniques, Copper/Ecosystems Interactions, Biological Availability, and Biological Uptake and Effects) each of which is reported upon in this summary publication. This report also includes abstracts of the papers presented in the AGU sessions. (Chilton-ORNL)
W79-05513

ECOLOGICAL BIOENERGETICS OF PHYSA ACUTA (GASTROPODA) IN HEATED WATERS,
Polish Academy of Sciences, Warsaw Lab. of Ecological Bioenergetics.
E. Kamler, and W. Mandecki.
Polskie Archiwum Hydrobiologii, Vol. 25, No. 4, p 833-868 1978. 12 fig, 8 tab, 64 ref.

Descriptors: *Environmental effects, *Thermal pollution, Heated waters, Snails, Energy budget, Productivity, Respiration, Reproduction.

Detailed studies of assimilation of P. acuta carried out, and the food consumption level was evaluated in two laboratory populations bred at 22 and 26C, respectively, under optimal nutritional conditions. The elements of this energy budget are described in the paper by 18 algebraic equations. During the whole life cycle of 260 and 203 days, respectively, total production cumulated was 390.9 and 366.3 cal/individual. Egg production was very high. The effect of high reproductive activity on respiration was discussed. By two calculation methods it was shown that the oxygen consumption level was higher than it was predicted from body production. Comparison of measured assimilation value with field density data indicate that P. acuta can effectively eliminate organic matter deposited in heated reservoirs and can serve as fish food. (Chilton-ORNL)
W79-05514

THE RECOVERY AND HEMATOLOGICAL REHABILITATION OF CHLORINE STRESSED ADULT RAINBOW TROUT (SALMO GAIRDNERI),
Consumers Power Co., Jackson, MI. Dept. of Environmental Services.
I. H. Zeitoun.
Environmental Biology of Fishes Vol. 3, No. 4, p 355-359 1978, 3 tab, 24 ref.

Descriptors: *Environmental effects, *Chlorination, Powerplants, Fish, Rainbow trout, Mortality, Resistance, Physiology, Toxicology.

Six separate test were conducted to test the ability of adult rainbow trout to recover from acute chlorine exposure. Blood was collected before the tests (control group), at the appearance of chlorine distress symptoms, and at 24 and 48 hours after exposures. Total residual chlorine (TRC) concentrations were 1.67, 3.50, 1.10, 1.25, 1.02, and 0.0 mg/1 at water temperatures of 13.5, 14.6, 17.2, 22.6, 23.0, and 26.0 C, respectively. At 48 hours after exposure, fish mortality was 11.5, 100, 0.0, 67.1, 36.1 and 100%. Blood of chlorine stressed fish showed signs of hemoconcentration and hemolysis. During recovery in chlorine-free water, all measured blood parameters returned to the control level within 24 hours with the exception of plasma hemolysis which was restored to control level within 48 hours. TRC concentrations of 3.5 mg/1 at 14.0 C and 1.25 and 1.02 mg/1 at 23 C significantly diminished recovery. It was concluded that chlorine induced stress does not necessarily lead to fish death and fish do recover successfully. (Chilton-ORNL)
W79-05515

ENTRAINMENT IMPACT ESTIMATES USING THE EQUIVALENT ADULT APPROACH,
National Power Plant Team, Ann Arbor, MI.
C. P. Goodyear.
For sale by the Superintendant of Documnents, U. S. Government Printing Office, Washington, D.C. 20402. Fish and Wildlife Service Report FWS/OBS-78/65, July 1978, 14 p. 2 fig, 4 tab, 5 ref.

Descriptors: *Environmental effects, *Entrainment, *Model studies, Fish, Forecasting, Mortality.

One approach to assessing the importance of entrainment mortality of eggs and larvae of fish and shellfish by power plants is to estimate the number of adult organisms which this loss represents. The limitations of this model which could lead to underestimates of the actual impact are discussed and an alternative formulation is presented which is designed to reduce the bias. The approach is expanded to provide estimates of numbers of fish caught by fishermen. (Chilton-ORNL)
W79-05516

IMPORTANCE OF ALGAE IN THE DIET OF THE OLIGOCHAETES LUMBRICULUS VARIEGATUS (MULLER) AND RHYACODRULUS SODALIS (EISEN),
Canada Environmental Protection Service, Yellowknife (Northwest Territories).
J. W. Moore.
Oecologia, Vol. 35, No. 3, 1978, p 357-363. 2 fig, 1 tab, 26 ref.

Descriptors: *Algae, *Food habits, *Oligochaetes, *Lumbriculus variegatus, *Rhyacodrilus sodalis, *Great Slave Lake(Northwest Territories, Canada), Eutrophication, Bays, Canada, Northwest Territories(Canada), Lakes, Detritus, Bacteria, Seasonal, Feeding rates, Annelids, Cold regions, Size, Nostoc, Cymatopleura elliptica, Cymbella, Epithemia turgida, Pinnularia, Synedra ulna, Abundance.

Analysis of gut contents of the oligochaetes Lumbriculus variegatus and Rhyacodrilus sodalis collected 1977-78 in a shallow, eutrophic bay in northern Great Slave Lake (Canadian subarctic) showed algae is very important in their diet, contrary to previous studies of deep, freshwater oligochaete populations in which food consisted almost exclusively of bacteria. In this study, during summer when algae were abundant they made up 70-85% of gut contents of the two species, whereas in winter when algal densities were low, detritus and associated bacteria became the major food source, and volume of food eaten decreased greatly. Total volume of gut contents in 35-50 mm speciments ranged from 1-2 cu mm in winter to 4.5 cu mm in May and 5.5 cu mm in June. All species of unicellular algae were consumed in proportion to their abundance in the environment, though size selection prohibited consumption of the very large colonies (over five mm diameter) of Nostoc pruniforme and N. verrucosum. Food availability rather than temperature was the major factor influencing algal consumption; although intensive feeding began as soon as temperatures rose above 0C in May, the rise in quantity of ingested algae was delayed until epipelic populations expanded in June. Most frequently ingested species were Cymatopleura elliptica, Cymbella spp, Epithemia turgida, Pinnularia spp, and Synedra ulna. (Lynch-Wisconsin)
W79-05517

EVALUATION OF PROPOSED TG AND E (TUCSON GAS AND ELECTRIC COMPANY) WASTEWATER DISCHARGE ON GROUNDWATER IN THE TUCSON BASIN,
Ground-Water Quality Consultant, Fresno, CA.
For primary bibliographic entry see Field 5E.
W79-05519

CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF TWO, RECREATION ORIENTED, OLIGOTROPHIC MOUNTAIN LAKES,
Arizona State Univ. Tempe.
S. M. Oakley, B. A. Segal, and R. M. Johnson.
Journal of the Arizona-Nevada Academy of Science, Vol. 12, No. 1, p 36-46, Feb. 1977. 6 fig, 12 tab, 18 ref.

Descriptors: *Lakes, *Oligotrophy, *Chemical properties, *Arizona, *Recreation wastes, *Pollutant identification, *Eutrophication, *Microbial degradation, *Limnology, Recreation facilities, Sampling, Water pollution source, Water quality, Biochemistry, Coliforms, Marine bacteria, Lake morphology, Lake stages.

The acceptable chemical and microbial conditions of a lake must be known early, to facilitate the detection of water quality changes as a lake experiences gross pollution and eutrophication from various types and levels of recreational use. The purpose of this study was to outline the microbiological and chemical properties of two relatively pristine lakes in Arizona, the Woods Canyon and the Bear Canyon lakes, to facilitate the detection of pollution brought about by recreational use. Both lakes are approximately the same size although Woods Canyon Lake, the more easily accessible of the two, was visited by 204,900 persons in 1974 while Bear Canyon Lake was visited by 47,700 people during the same period. Total bacterial counts were made from May through October on a medium with conditions similar to those extant in the lakes, and coliform and fecal streptococci bacteria were enumerated along with attempts to isolate specialized bacteria associated with geochemical cycles. Samples were obtained from the sites from May to August and analyzed according to standard methods. Results indicated that while both lakes are subjected to varying degrees of human use at the present time, all bacterial parameters studied indicate that both lakes are able to recover at this time from the current human use and that some increase in use at Bear Canyon Lake would not be harmful. (Tickes-Arizona)
W79-05564

CULTIVATING AND HARVESTING ALGAE TO FORESTALL ACCELERATED EUTROPHICATION,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
N. Marshall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 019, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Rhode Island, Completion Report, 1979. 47 p, 27 fig, 10 tab, 13 ref. OWRT A-065-R1(1), 14-34-0001-8042.

Descriptors: Ulva, Gracilaria, Ammonia uptake, Sewage treatment, *Eutrophication, *Harvesting of algae, Nitrogen.

The effects of a variety of light, ammonia and water motion regimes on the growth and carbon and nitrogen composition of the marine macroalgae Ulva lactuca and Gracilaria tikvahiae were tested by laboratory experimentation. Rates of ammonia uptake were also observed during the experiments. In almost every experiment a low level of simulated current enhanced algal growth and ammonia uptake rates but the current effect soon reached a plateau beyond 7.5 cm sec-1. Total ammonia uptake and algal tissue nitrogen were positively correlated with ammonia concentration. Variations related to levels of all factors tested are reported in detail. Growth of these species was also tested in the field, including in a cove which received considerable sewage input and high ammonia loading. Based on growth observations in this environment and laboratory nitrogen incorporation in high ammonia concentrations, it is concluded that cultivation of these species near sewage outfalls in marine coves could remove a significant portion of the excess nitrogen on a seasonal basis.
W79-05584

ECOLOGICAL STUDIES OF THE ANNUAL RED ALGA DUMONTIA NCRASSATA (O.F. MULLER) LAMOUROUX,
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.
J. A. Kilar, and A. C. Mathieson.
Botanica Marina, Vol. 21, No. 7, p 423-437. October 1978. 24 fig, 2 tab, 44 ref.

Descriptors: *Dumontia incrassata, *Seasonal, *Reproduction, *Ecology, *Phenology, *Tidal pools, Algae, Rhodophyta, Marine algae, New Hampshire, Jaffrey Point(NH), Dover Point(NH), Spores, Periodicity, Gametophytes, Biomass, Plant growth, Growth stages, Nutrients, Atlantic Ocean, Estuaries, Abundance, Habitats, Tetraspores, New England.

Seasonal growth and reproduction of the red alga Dumontia incrassata studied at two sites on the New Hampshire coast (Dover Point and Jarrey Point) were greatest during the winter-spring period of low temperatures (less than 10C) and at high nutrient levels. Gametophytic generations were more restricted in seasonal periodicity than asexual plants. Tetrasporic plants were dominant despite a 1:1 ratio of asexual to sexual plants. Spores were liberated in spring and summer and germinated in fall. Reproduction began during the period of maximum stature; the largest plants and greatest number of gametophytic plants occurred in March. However, maximum biomass, associated with development of mature tetraspores and carpospores on the thallus, occurred in April and thus did not coincide with maximum stature. Maximum reproduction accompanied declining growth, unlike such other seaweeds as Gigartina stellata and Codium fragile. Differences in habitat and winter conditions strongly affected the phenology of D. incrassata, with greatest reproductive differences observed in the highest pool. The study was conducted March 1976-February 1977, with water characteristics recorded at Jaffrey Point, New Castle, and Dover Point, and D. incrassata studied at two tidal pools at Jaffrey Point and in a series of estuarine depressions at Dover Point. (Lynch-Wisconsin)
W79-05618

ECO-BIOCHEMICAL STUDIES ON SOME ECONOMICALLY IMPORTANT INTERTIDAL ALGAE FROM PORT OKHA (INDIA),
Saurashtra Univ., Rajkot (India). Dept. of Biosciences.
M. S. Murthy, and P. Radia.
Botanica Marina, Vol. 21, No. 7, p 417-422 October 1978.

Descriptors: *Okha(India), *Ulva lactuca, *Gelidiella acerosa, *Sargassum swartzii, *Algae, *Biochemistry, *Ecology, *Commercial algae harvesting, India, Intertidal areas, Nitrogen, Fats, Carbohydrates, Proteins, Sodium, Potassium, Calcium, Phosphorus, Chemical analysis, Seasonal, Arabian Sea, Gulf of Kutch(India), Fertilizers, Foods.

Biochemical content of the intertidal algae Ulva lactuca (Chlorophycea), Gelidiella acerosa (Rhodophyceae), and Sargassum swartzii (Phaeophyceae) from the coast at Port Okha on the Gulf of Kutch (Arabian Sea), Gujarat State, India was correlated with ecological factors of the marine environment. Results showed: (1) close relationship between net primary productivity and protein content in S. swartzii; (2) inverse relationship between crude fat and crude fiber content in all three algae; (3) temperature, salinity, and pH had no effect on biochemical content of the algae; and (4) water deficiency resulting from increased exposure and consequent increased light enhanced fat formation in S. swartzii and G. acerosa. The three algae, all of present or potential importance for food, fodder or fertilizer were studied during one growing season from June-February (except U. lactuca, studied from September). Total nitrogen, crude protein, carbohydrates, sodium, potassium, calcium, and phosphorus were determined for the algal material, and seawater was analyzed for temperature, pH, salinity, sodium, potassium, calcium, and phosphorus. In general, algal and seawater content of sodium, potassium, calcium, and phosphorus, showed peaks in June and October, comparatively lower values in December and January, and a sharp rise in February. Algal protein content showed great fluctuations from month to month. (Lynch-Wisconsin)
W79-05630

PATTERNS OF ALGAL SUCCESSION IN A PERTURBATED MARINE INTERTIDAL COMMUNITY,
California State Univ., Fullerton. Dept. of Biological Science.
S. N. Murray, and M. M. Littler.
Journal of Phycology, Vol. 14, p 506-512, 1978. 2 fig, 4 tab, 29 ref. (California Water Resources Center Project UCAL-WRC-W-491). OWRT A-054-CAL(8).

Descriptors: *Aquatic algae, Succession, *Biological communities, *Environmental effects, *Intertidal areas, Sewage, *Water pollution, *Water pollution effects, Marine algae, Marine microorganisms, Microenvironment.

Patterns of algal succession for a sewage-polluted and an unpolluted habitat near Wilson Cove, San Clemente Island, California, were studied from December 1974 to June 1977. Resident populations were analyzed for 56 fully denuded and 34 undisturbed control quadrats during 11 assessment periods. The denuded quadrats in the perturbated (polluted) habitat showed recovery within 1.0 mo as determined by cover, percent similarity and species diversity comparisons with control plots. The short recovery times of the algal populations dominating the perturbated habitat indicate that these species maintain relatively constant overall abundances due to their potential for rapid recruitment and growth. Denuded quadrats in an unpolluted habitat did not show recovery even after 30.0 mo. These quadrats were dominated during the first 1.3 mo by algae characteristic of the perturbated area, including filamentous Ectocarpaceae, colonial diatoms and bluegreen algae. The similarity between the species occupying the sterilized plots during the first few months and those that provide the majority of cover in the perturbated area supports the hypothesis that the dominant algae of the upper and mid-intertidal regions of this habitat consist largely of early successional or opportunistic species with high capacities for growth and reproduction. Additionally, these experiments suggest that algal populations described for other perturbated epilithic systems also represent resilient subclimax associations. (Snyder-Calif., Davis)
W79-05664

BASELINE CHARACTERIZATION OF MARINE MAMMALS IN THE BERING SEA: DISTRIBUTION AND ABUNDANCE,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
H. Braham, and D. Rugh.
IN: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol 1, Receptors--Mammals--Birds, p 1-14, October 1978. 1 fig, 1 tab, 25 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Baseline studies, *Environmental effects, *Alaska, *Mammals, Water pollution effects, Migration, Temporal distribution, Spatial distribution, Abundance, *Outer Continental Shelf, *Ecological distribution, Whales, Gray whales, Sea lions, Eumetopias jubatus, Eschrichtius robustus, Bering Sea.

Final analysis of the northern sea lion (Eumetropias jubatus) data confirmed earlier diagnosis that a 50% decline in the population has occurred in the eastern Aleutian Islands study area since the late 1950's and early 1960's. Data on the fall migration of the California gray whale (Eschrichtius robustus) were compiled. Results showed that about 75% of the population leaves the Bering Sea through Unimak Pass during the last two weeks of November and the first week of December. (Sinha-OEIS)
W79-05665

SEASONAL DISTRIBUTION AND RELATIVE ABUNDANCE OF MARINE MAMMALS IN THE GULF OF ALASKA,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
H. W. Braham, and R. W. Mercer.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. 1, Receptors--Mammals--Birds, p 15-28, October 1978. 3 fig, 2 tab, 22 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, CO., R7120806.

Descriptors: *Baseline studies, *Environmental effects, *Alaska, *Mammals, Water pollution effects, Migration, Abundance, Temporal distribution, Oil pollution, Resources development, *Outer Continental Shelf, Ecological distribution, Gulf of Alaska.

Dall porpoises migrate across the Kodiak and Northeast GOA oil lease sites, apparently in greatest numbers in the spring (especially May). Preliminary plots indicate that Prince William Sound is an important summering area, however the Kodiak Island oil lease area also appears to be of as yet undetermined importance during the summer. The location of greatest concentration from June through August is Unimak Pass and along the continental edge in the southern Bering Sea. Whether these animals are migrants from the GOA or the western North Pacific Ocean is unknown. California gray whales twice migrate through six oil lease tracts in Alaska each year. Preliminary evidence indicate that up to 75% of the population moves by Unimak Pass, and perhaps Kodiak Island, during a three week period in the fall. Any adverse effects on gray whales resulting from oil-gas development would be accentuated during this period of animal concentration. (Sinha-OEIS)
W79-05666

SEASONAL DISTRIBUTION AND ABUNDANCE OF BOWHEAD AND BELUGA WHALES IN THE BERING SEA AND ARCTIC OCEAN,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
H. W. Braham, and B. D. Krogman.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol 1, Receptors--Mammals--Birds, p 29-38, October 1978. 1 tab, 1 ref. NOAA Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Baseline studies, *Temporal distribution, *Spatial distribution, *Mammals, *Alaska, Computer programs, Environmental effects, Resources development, Arctic Ocean, *Outer Continental Shelf, Whales, Beluga whales, Bowhead whales, Bering Sea.

Field data were analyzed to identify bias in sampling techniques. Poor visibility conditions do not constitute a significant negative bias which must be adjusted. Data are too scant to conclude that lead width greatly influences rates of whale movements by Barrow during the spring sampling period. A computer format is partially presented as a medium for analysis and storage of whale survey data collected from fixed stations. The ice camp index is evaluated as a measure of total population abundance, and components of the bowhead population are categorized as related to the index. (Sinha-OEIS)
W79-05667

MORBIDITY AND MORTALITY OF MARINE MAMMALS,
Alaska Univ., Fairbanks. Inst. of Marine Science; and Alaska Univ., Fairbanks. Inst. of Arctic Biology.
F. H. Fay, R. A. Dieterich, L. M. Shults, and B. P. Kelly.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. 1, Receptors--Mammals--Birds, p 39-79, October 1978. 2 fig, 5 tab, 65 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Baseline studies, *Pathology, *Water pollution effects, *Mammals, *Environmental effects, Morbidity, Mortality, Ecosystems, Resources development, Alaska, *Outer Continental Shelf, Gulf of Alaska, Bering Sea.

The common pathological conditions and their causes in marine mammals of the Bering Sea and Gulf of Alaska - Cook Inlet region are identified. Because they are highly visible and are the main top level consumers in the marine system, marine mammals may provide the best, most easily assessed index of the 'health' of the marine system as a whole. Present knowledge of the morbidity/mortality factors affecting species inhabiting the Alaskan shelf water is summarized. Predation and parasitism seem to be the principal causes of natural illness and death, followed closely by malnutrition. Investigations in the past year have centered on necropsy of samples drawn from the living populations in the eastern Bering Sea and Gulf of Alaska. In the 96 collected specimens examined, the most frequently occurring gross pathological conditions were: (1) hepatitis, probably of helminthic origin; (2) pneumonitis, also principally caused by helminths; (3) dermatitis, of fungal, bacterial, and possibly viral origin; (4) wounds, from various causes; and (5) gastric ulcers caused by parasitic invasions. Parasites and microbiological infections seem often to be sufficiently debilitating to predispose these animals to predation. (Sinha-OEIS)
W79-05668

BIOLOGY OF THE HARBOR SEAL, PHOCA VITULINA RICHARDI, IN THE GULF OF ALASKA,
Alaska Dept. of Fish and Game, Anchorage.
K. Pitcher, and D. Calkins.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. 1, Receptors--Mammals--Birds, p 80-98, October 1978. 3 fig, 12 tab, 3 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-69.

Descriptors: *Baseline studies, *Mammals, *Life history studies, *Ecology, Oil pollution, Water pollution effects, Resources development, Environmental effects, *Outer Continental Shelf, Gulf of Alaska, Seals, Harbor seals, Petroleum, Phoca vitulina richardi.

Four collecting trips were completed during calendar year 1977 resulting in the taking of 125 harbor seals to study the life history of the harbor seal in the Gulf of Alaska. Exploration, development and transportation of petroleum reserves in the Gulf of Alaska have a number of potential harmful effects on harbor seal populations. Some of the more obvious include the following: (1) direct injury to animals through contact with or ingestion of oil (this may result directly in death of the individuals involved or could result in lowered physical condition which in turn might alter long term survival and biological processes such as growth and reproduction), (2) disturbance, particularly during vulnerable stages of their life cycle such as pupping and molting, (3) reduction of productivity of the marine system by contamination, (4) direct mortality of important prey species by contact with oil and (5) increased levels of environmental contaminants. This project was designed to collect information to aid in the decision making process for gas and oil development in the Gulf of Alaska. Data gathered will enable development of guidelines for all stages of the OCS development program which will reduce harmful effects on harbor seal populations. Predevelopment data are being collected so changes which might occur can be detected. (Sinha-OEIS)
W79-05669

THE NATURAL HISTORY AND ECOLOGY OF THE BEARDED SEAL (ERIGNATHUS BARBATUS) AND THE RINGED SEAL (PHOCA HISPIDA),
Alaska Dept. of Fish and Game, Fairbanks.
J. J. Burns, and T. J. Eley.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. 1, Receptors--Mammals--Birds, p 99-160, October 1978. 17 tab, 135 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 02-5-022-53.

Descriptors: *Ecology, *Life history studies, *Baseline studies, Resources development, Oil pollution, Water pollution effects, Environmental effects, Alaska, Mammals, *Outer Continental Shelf, Bering Sea, Beaufort Sea, Shukchi Sea, Bearded seal, Ringed seal, Erignathus barbatus, Phoca hispida.

Ringed seals, Phoca hispida, and bearded seals, Erignathus barbatus, are major components of the marine mammal fauna of the Bering, Chukchi, and Beaufort Seas. They have been chosen as target species for investigation based upon criteria including their significance in the ecosystem, importance to people residing along the coast, and considerations of timeliness, feasibility, and applicability to OCS requirements. The ringed seal is a small, widely distributed and very abundant species which mainly occurs in areas of extensive, relatively thick and stable sea ice. In marked contrast, bearded seals are the largest of the northern seals. They are also widely distributed, but occur in the drifting ice. They feed almost exclusively on benthic organisms. Proposed OCS lease areas in the Bering, Chukchi, and Beaufort Seas are within the habitat of these seal species and pose a real threat to their populations. The objectives of the studies are to develop a baseline of ecological and behavioral data in order to prevent to lessen adverse impacts of outer continental shelf development. (Sinha-OEIS)
W79-05670

TROPHIC RELATIONSHIPS AMONG ICE INHABITING PHOCID SEALS,
Alaska Dept. of Fish and Game, Fairbanks.
L. F. Lowry, K. J. Frost, and J. J. Burns.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. 1, Receptors--Mammals--Birds, p 161-365, October 1978. 5 fig, 31 tab, 62 ref, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-53.

Descriptors: *Mammals, *Ice, *Ecology, *Habitats, Baseline studies, Environmental effects, Resources development, Life history studies, Water pollution effects, Alaska, *Outer Continental Shelf, *Trophic relationships, *Food habits, Bering Sea, Beaufort Sea, Chukchi Sea, Petroleum.

Ice inhabiting seals are highly visible, numerous, sociologically and economically important species in the Bering-Chukchi and Beaufort marine ecosystems. A complete understanding of the role of these seals in the trophic structure of these ecosystems is crucial to the evaluation of potential impacts of OCS development. Key areas and times of foraging must be determined and will have direct bearing on the suitability of various areas for leasing. When key prey species have been identified and data correlated with information on the distribution, abundance and natural history of these prey species (from other projects), an evaluation of effects of OCS development on the flood base of the seals can be made. By understanding the trophic relationships among ice inhabiting seals and other consumers in the system, indirect effects of OCS development (e.g. those favoring population increase of potential food resource competitors) can be predicted. It appears that ringed seals feed primarily on benthic invertebrates and fishes, spotted seals eat pelagic and demersal fishes and crustaceans, and ribbon seals consume fishes, cephalopods and shrimp. A total of 689 specimens are included in this report, approximately double the number reported on in 1977. Results are presented by locality and time of year within four major geographical areas: southeastern Bering Sea, northern Bering Sea, Chukchi Sea and Beaufort Sea. General feeding patterns are discussed for each species in each area. A brief evaluation of geographical, temporal and age- and sex-related dietary differences is made. (Sinha-OEIS)
W79-05671

AN AMENDMENT TO RU232 TROPHIC RELATIONSHIPS AMONG ICE INHABITING PHOCID SEALS, AND RU230 NATURAL HISTORY OF RINGED AND BEARDED SEALS,
Alaska Univ., Fairbanks. Inst. of Marine Science; and Alaska Univ., Fairbanks. Inst. of Arctic Biology.
F. H. Fay, and L. M. Shults.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. 1, Receptors--Mammals--Birds, p 366-372, October 1978. 2 tab, 6 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Baseline studies, *Mammals, *Pathology, *Ecology, Ice, Resources development, Water pollution effects, Heavy metals, Pesticides, Oil pollution, Environmental effects, Alaska, *Outer Continental shelf, Beaufort Sea, Seals, Food habits, Phoca hispida, Erignathus barbatus.

Marine mammals are the only resident top level consumers in the Beaufort Sea ecosystem. Because of this, their health and welfare, is indicative of the 'health' of the marine ecosystem itself, since they are the ultimate recipients of all changes that take place within the system, from perturbation and pollution to simple physical disturbance. Because they tend to be long-lived, they can provide a cumulative historical record of past conditions, e.g., in their overall growth and the growth of certain body parts, and in their stores of certain pollutants, such as heavy metals and pesticides. They also are responsive to short-term changes, which are reflected in their migrations, nutrition, and reproduction. The objective of this study was to provide baseline information on the kinds and rates of occurrence of natural pathological conditions and their causative agents in the living populations of bearded and ringed seals of the Beaufort Sea. Necropsies were performed on 16 ringed seals, Phoca hispida, and 5 bearded seals, Erignathus barbatus, collected during the multidisciplinary research cruise of the USCGC Glacier in the Beaufort Sea during August and September 1977. Each of these pinnipeds was found to have several kinds of endoparasitic helminths and about half of them exhibited pathological conditions in the liver. (Sinha-OEIS)
W79-05672

POPULATION ASSESSMENT, ECOLOGY AND TROPHIC RELATIONSHIPS OF STELLER SEA LIONS IN THE GULF OF ALASKA,
Alaska Dept. of Fish and Game, Anchorage.
D. Calkins, and K. Pitcher.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol 1 Receptors--Mammals--Birds, p 373-413, October 1978. 6 fig, 13 tab, 6 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-69.

Descriptors: *Mammals, *Ecology, *Life history studies, *Abundance, Distribution, Resources development, Water pollution effects, Environmental effects, Oil pollution, Alaska, *Outer Continental Shelf, *Gulf of Alaska, *Trophic relationships, Population assessment, Steller sea lions, Eumetopia jubatus, Delphinapterus leucus, Enhydra lutris.

Population dynamics, life history and some aspects of the ecology of the Steller sea lion (Eumetopia jubatus) were studied. In addition to the sea lion investigations, an examination of the distribution and abundance of belukha whales (Delphinapterus leucus) in Cook Inlet and the distribution and abundance of sea otters (Enhydra lutris) near the south end of the Kodiak Archipelago were also studied. The basic objectives of the sea lion work are to provide information on population status, seasonal distribution, movement patterns, population composition and segregation, use of critical

abitats, food habits, reproductive biology and roductivity. Other objectives include collection f information on growth, pathology and environental contaminant loads. Objectives of the beluha work are to gather information on seasonal istribution, and abundance and use of critical abitats; to test practicality of survey methods and o supply information which can be used to design research project on this population. The sea otter ork is to provide information on the distribution f sea otters in the area between Kodiak Island and Chirikof Island, to identify specific areas critical to hese sea otters and to determine the extent of epopulation in this former sea otter habitat. This tudy has been designed to examine the potential mpacts associated with exploration for, developent of and transportation of crude oil and natural as reserves in the Gulf of Alaska. All three speies studied are vulnerable to Outer Continental Shelf oil and gas development through direct conact and contamination, indirect contamination of ood sources or habitat, and disturbance generated y exploration activities. (Sinha-OEIS)
W79-05673

A SURVEY OF CETACEANS OF PRINCE WILLIAM SOUND AND ADJACENT VICINITY - THEIR NUMBERS AND SEASONAL MOVEMENTS,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services; and National Marine Fisheries Services, Seattle, WA.
. D. Hall, and J. H. Johnson.
n: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol 1, Receptors--Mammals--Birds, p 414-426, October 978. 1 tab, 10 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 01-6-022-15670.

Descriptors: *Baseline studies, *Abundance, *Temporal distribution, *Mammals, Water pollution effects, Oil spills, Environmental effects, Alaska, *Outer Continental Shelf, *Cetaceans, Feeding habits, Petroleum transport, Prince William Sound, Gulf of Alaska, Porpoises.

Basic objectives of this first year of a planned three-year project are to document the relative numbers and seasonal distribution of cetaceans in Prince William Sound, Alaska, and to determine major foraging and accumulation areas for principal species. The results presented in this report represent part of the effort by the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Alaska Department of Fish and Game to obtain baseline resource data from outer continental shelf areas in Alaska to evaluate the probable impacts on natural resources from development of petroleum reserves. Of more general importance than the effect of oil spills on cetaceans is the likelihood of disturbance to cetacean populations by exploratory and development activity in the lease areas and from or by marine petroleum transport corridors, such as Hinchinbrook Entrance and the port of Valdez. (Sinha-OEIS)
W79-05674

IDENTIFICATION, DOCUMENTATION AND DELINEATION OF COASTAL MIGRATORY BIRD HABITAT IN ALASKA,
Alaska Dept. of Fish and Game, Anchorage.
P. D. Arneson.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol 1, Receptors--Mammals--Birds, p 431-481, October 1978. 10 fig, 12 tab, 8 ref, 3 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-5-022-69.

Descriptors: *Birds, *Migratory birds, *Oil spills, *Water pollution effects, Baseline studies, Environmental effects, Alaska, Resources development, Habitats, *Outer Continental Shelf, Feeding habits, Bristol Bay, Cook Inlet, Petroleum transport.

Marine birds annually congregate in large numbers along the coast of Alaska. For the past two and one half years, the overall objective of this project was to quantify the seasonal distribution of birds in coastal habitats. A second objective was to determine which areas or habitats are critical to the welfare of marine birds. Studies for the current reporting period were confined to Bristol Bay and Lower Cook Inlet. The world's population of the dark-color phase Brant and most of the world's population of Emperor Geese use the north side of the Alaska Peninsula during migration. An untimely, catastrophic spill could destroy both populations either directly or through habitat destruction. Both dabbling ducks and shorebirds would most be affected in the event of an oil spill by destruction of food organisms in intertidal and supratidal areas. Based on this winter's surveys only, it appears as if few wintering birds would be affected by oil spills or development in the middle or western sides of Lower Cook Inlet. If oil were spilled during winter months and deposited in Kamishak Bay, it may affect birds indirectly in other seasons by destroying their food organisms. (Sinha-OEIS)
W79-05675

IDENTIFICATION, DOCUMENTATION AND DELINEATION OF COASTAL MIGRATORY BIRD HABITAT IN ALASKA. I: BREEDING BIRD USE OF BARRIER ISLANDS IN THE NORTHERN CHUKCHI AND BEAUFORT SEAS,
Point Reyes Bird Observatory, Stinson Beach, CA.
G. J. Divoky.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. 1, Receptors--Mammals--Birds, p 482-548, October 1978. 35 fig, 2 tab, 18 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-69.

Descriptors: *Migratory birds, *Habitats, *Alaska, *Breeding, Resources development, Baseline studies, Environmental effects, Water pollution effects, *Outer Continental Shelf, Beaufort Sea, Chukchi Sea, Petroleum transport.

Between Cape Lisburne and Demarcation Point there are over 60 barrier islands and spits in the nearshore waters of the Chukchi and Beaufort seas. These islands and spits provide a unique seabird nesting habitat that is not found elsewhere in the state of Alaska. Because the islands offer ideal platforms for drilling rigs and causeways, the exploitation of oil and gas from beneath the Chukchi and Beaufort seas will result in increased human activity on and next to the islands. In 1976 a survey of these islands was conducted in order to determine the importance of these islands to nesting birds. Information on breeding phenology and clutch size was also obtained. Islands that are known to support a larger population or a single species or small populations of a number of species can be considered to be critical habitats. Steps should be taken to minimize the impacts on such islands or to schedule human activities when breeding birds are not present. Islands with smaller populations should also be protected but restrictions on human activity need not be as severe. Because this study identifies which factors are most important in determining the use of islands by breeding birds, it may be possible to increase bird numbers by substrate and cover manipulation on selected islands. Such manipulation would lessen the impact that man's activities will have in reducing the overall number of birds breeding on the islands. (Sinha-OEIS)
W79-05676

IDENTIFICATION, DOCUMENTATION AND DELINEATION OF COASTAL MIGRATORY BIRD HABITAT IN ALASKA. II: FEEDING HABITS OF BIRDS IN THE BEAUFORT SEA,
Point Reyes Bird Observatory, Stinson Beach, CA.
G. J. Divoky.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. 1, Receptors--Mammals--Birds, p 549-569, October 1978. 13 tab, 3 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-69.

Descriptors: *Migratory birds, *Foods, *Alaska, Ecosystems, Crustaceans, *Outer Continental Shelf, Beaufort Sea, Feeding habits.

In 1976 as part of a general survey of avian use of coastal habitats in the Beaufort Sea a number of birds were collected so that their stomach contents could be analyzed. The objectives of the study were to determine which prey species are most important to the birds feeding in the Beaufort and the relative importance of these species throughout the summer and fall. This report presents the first information on the food of marine birds in the Beaufort Sea. Preliminary results show that a variety of crustaceans are consumed by nearshore birds with amphipods, mysids and euphausids being the principal prey. For species occurring further offshore Arctic Cod (Boreogadus saida) is the most important food. Further analysis of the data will allow the determination of the time periods when each prey species is most important and the habitat in which the prey is usually consumed. The sensitivities of these prey species and habitats can then be examined in order to determine how oil and gas development will affect the populations the birds feed on. (Sinha-OEIS)
W79-05677

REPRODUCTIVE ECOLOGY, FOODS AND FORAGING AREAS OF SEABIRDS NESTING ON THE PRIBILOF ISLANDS,
California Univ., Irvine.
G. L. Hunt, Jr., B. Mayer, W. Rodstrom, and R. Squibb.
In: Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. 1, Receptors--Mammals--Birds, p 570-775, October 1978. 36 fig, 37 tab, 53 ref, 4 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-72.

Descriptors: *Birds, *Resources development, *Environmental effects, *Alaska, Aircraft, Baseline studies, Water pollution effects, Oil pollution, *Outer Continental Shelf, Pribilof Islands, Rissa, Uria Phalarcrocorax.

Data were obtained on the breeding season ecology of the eleven seabird species nesting on the Pribilof Islands of Alaska to determine what aspects of this ecology would be particularly sensitive to potential oil development activities. Data suitable for baseline use were obtained in the summers of 1975, 1976, and 1977 for timing of reproduction for Black-legged Kittiwake (Rissa tridactyla), Red-legged Kittiwake (R. brevirostris), Common Murre (Uria aalge) and Thick-billed Murre (U. lomvia) and to a modest extent for Red-faced Cormorants (Phalacrocorax urile). Preliminary indications of foraging areas for species nesting in the Pribilofs were obtained during cruises in August 1975, June and July 1976, and July and August 1977. On three occasions the effect of aircraft movements close to seabird colonies was noted. The implication is that in OCS oil development and in the coincident monitoring of natural populations, all aircraft should be restricted from flying near colonies. It is likely that, in terms of ongoing oil production, disturbance by aircraft could be as damaging to bird reproduction as spilled oil. These tentative observations have the further implication that aircraft should not be used to monitor the reproductive output of Kittiwakes or the size of bird colonies if these operations require flying in the proximity of cliffs while murres have either eggs or chicks. (Sinha-OEIS)
W79-05678

MAN'S IMPACT ON THE MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT--SYMPOSIUM SUMMARY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
For primary bibliographic entry see Field 5B.
W79-05679

PHYSICAL OCEANOGRAPHY OF THE MIDDLE ATLANTIC BIGHT,
Woods Hole Oceanographic Institution, MA.; Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.; and National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 2J.
W79-05680

NEW YORK BIGHT WATER STRATIFICATION--OCTOBER 1974,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 1A.
W79-05682

DISTRIBUTION OF HYDROGRAPHIC PROPERTIES IN THE NEW YORK BIGHT APEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 1A.
W79-05683

SPATIAL AND TEMPORAL VARIATION IN SEDIMENTARY GRAIN-SIZE FACIES AND SEDIMENT HEAVY METAL RATIOS IN THE NEW YORK BIGHT APEX,
Brooklyn Coll., NY. Dept. of Geology.
W. H. Harris.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 102-123, 1976. 6 fig, 4 tab, 63 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Heavy metals, *Water pollution, *Environmental effects, *Sediments, Spatial distribution, Temporal distribution, Sewage sludge, Chromium, Zinc, Mud, *Outer Continental Shelf, *New York Bight, Ocean dumping.

In northwest New York Bight a pronounced spatial and temporal variation occurs in sediment grain-size, heavy metal ratios, and concentrations. Substrate mobility is most pronounced near Long Island and in northern Christiaensen Basin. Near Long Island mud patches are most extensive during late spring through summer and may coalesce across intervening sand-wave crests obliterating the shore-zone sand-wave topography. Mud-patches are either restricted to sand-wave trough axes or are absent or covered during early fall through early spring, suggesting that muddy sediments are either flushed from the nearshore wind-wave system by bottom currents or undergo in situ microbial degradation. Individual mud patches near Long Island have not existed for a long time. Mud patches off Atlantic Beach and Lido Beach, Long Island, began to develop as early as summer 1972; others developed later. The Cr:Zn ratio varies in mud deposits at the sludge disposal area, northern Christiaensen Basin, and Hempstead Bay and in mud patches near Long Island. Maximum Cr:Zn values occur during late spring through early fall, minimum values during early winter. Cr:Zn annual maximum may be explained by preferential desorption from sludge or mud solids by cation exchange, or preferential adsorption of organic chromium chelates from solution by organic mud substrates, or zinc uptake by phytoplankton or bacteria. The Cr:Zn annual minimum may be explained by dissolution of Mn and Fe hydroxides releasing adsorbed Zn and Cr or oxidation of the organosulfur compounds of the two metals at nearly equal rates. (Sinha-OEIS)
W79-05686

SUSPENDED PARTICULATE CONCENTRATIONS AND COMPOSITIONS IN THE NEW YORK BIGHT,
Lamont-Doherty Geological Observatory, Palisades, NY.
P. E. Biscaye, and C. R. Olsen.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 124-137, 1976. 14 fig, 1 tab, 8 ref. Allen Press Inc., Lawrence, Kansas. Also as: Lamont-Doherty Geological Observatory Contribution No 2414. ERDA-E(11-1)2185.

Descriptors: *Metals, *Sediment transport, *Environmental effects, Water pollution, Suspended solids, *Outer Continental Shelf, *New York Bight, *Ocean dumping.

Suspended particulate concentrations in the New York Bight during 1973-1975 decrease seaward across the shelf, decreasing more rapidly in surface than in bottom waters. Resuspension of fine-grained sediments causes local high concentrations of suspended particles in near-bottom waters. Horizontal displacement of these high concentration plumes from their sources suggests short residence times for suspended particles. Verticle mixing of resuspended particles is limited by the thermocline. Along the upper continental slope over a depth range of approximately 1,000 m, there is a minimum in near-bottom suspended particulate concentrations suggesting horizontal mixing with waters from the open ocean. Anomalous concentrations of trace metals of anthropogenic origin associated with organic particles, Fe-Ti (oxide) coatings and discrete Ti (oxide) particles are potential tracers of particle dispersion paths and transport processes. Different types of organic particles exhibit different interparticle and trace element associations and appear to have different geographic distributions. Some of this variability may be seasonal. Surface water suspended matter has a higher proportion of biogenic (inorganic skeletal as well as organic) particles than near-bottom suspended matter which is dominantly nonbiogenic (principally aluminosilicate). Skeletal debris is primarily siliceous in shelf waters, becoming more carbonate-rich seaward of the shelf break. Aluminocilicate suspended particles in shelf waters are predominately K-rich whereas Mg-Ca-K-Fe-rich aluminosilicates dominate beyond the shelf break. (Sinha-OEIS)
W79-05687

SOURCES OF URBAN WASTES,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
For primary bibliographic entry see Field 5B.
W79-05689

CONTAMINANTS ENTERING THE NEW YORK BIGHT: SOURCES, MASS LOADS, SIGNIFICANCE,
Manhattan Coll., Bronx, NY. Dept. of Environmental Engineering and Science.
For primary bibliographic entry see Field 5B.
W79-05690

TRACE METALS IN THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5B.
W79-05691

PRELIMINARY ANALYSIS OF THE DISPERSION OF SEWAGE SLUDGE DISCHARGED FROM VESSELS TO NEW YORK BIGHT WATERS,
Corvallis Environmental Research Lab., OR. Marine and Freshwater Ecology Branch.
For primary bibliographic entry see Field 5B.
W79-05692

RARITAN BAY AS A SOURCE OF AMMONIUM AND CHLOROPHYLL A FOR THE NEW YORK BIGHT APEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5B.
W79-05693

OXYGEN DEPLETION IN THE NEW YORK BIGHT APEX: CAUSES AND CONSEQUENCES,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5B.
W79-05694

CARBOHYDRATES AND ORGANIC CARBON IN NEW YORK BIGHT SEDIMENTS AS POSSIBLE INDICATORS OF SEWAGE CONTAMINATION,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5B.
W79-05695

A CONCEPTUAL REPRESENTATION OF THE NEW YORK BIGHT ECOSYSTEM,
Resource Management Associates, Lafayette, CA.; and Tetra Tech, Inc., Lafayette, CA.
For primary bibliographic entry see Field 5B.
W79-05696

PHYTOPLANKTON PRODUCTIVITY IN THE APEX OF THE NEW YORK BIGHT: ENVIRONMENTAL REGULATION OF PRODUCTIVITY/CHLOROPHYLL A,
City Coll., New York. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W79-05697

MICROBIOLOGICAL STUDIES OF THE ATLANTIC CONTINENTAL SHELF,
Maryland Univ., College Park. Dept. of Microbiology.
R. R. Colwell, J. D. Walker, G. S. Sayler, P. A. Seesman, and B. F. Conrad.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 275-280, 1976. 3 fig, 7 tab, 10 ref. Allen Press, Inc., Lawrence, Kansas. ONR-N00014-67-A-0239-0027.

Descriptors: *Oil pollution, *Polychlorinated biphenyls, Microorganisms, *Sediments, Water pollution effects, Environmental effects, Resources development, Microbial degradation, Drilling, Offshore platforms, *Outer Continental Shelf, Hydrocarbons, Petroleum, US Southeast Coast.

Microbial degradation of petroleum, polychlorinated biphenyls, and similar substances was investigated in the laboratory and at stations in the Atlantic Ocean near offshore drilling sites. Microorganisms were analyzed as to type, including total viable, aerobic, heterotrophic and petroleum-degrading bacteria, yeasts and fungi, actinomycetes, and chitin-hydrolyzing bacteria. Mixed hydrocarbon substrate generally yielded higher counts than media made up with South Louisiana crude oil. The inorganic nutrient (PO4, NO3, NO2, NH4) content of the seawater medium influenced the amount of petroleum hydrocarbons degraded by microorganisms present in sediment and in the water column. Sediment bacteria from the deep ocean environment (3,500 m) were able to degrade crude oil; microorganisms present in surface seawater samples collected at stations along the southeast Atlantic coast degraded crude oil, but the microbial potential for degradation of oil was limited. Polychlorinated biphenyl (PCB) and PCB-degrading bacteria were recovered from surface water and sediment samples collected along the southeast Atlantic coast from Miami to Cape Hatteras. Oil and PCB-degrading bacteria are potential indices for oil and PCB contamination. (Sinha-OEIS)
W79-05698

EFFECTS OF COASTAL POLLUTION ON FISH AND FISHERIES--WITH PARTICULAR

REFERENCE TO THE MIDDLE ATLANTIC BIGHT,
National Marine Fisheries Service, Highlands, NJ. Middle Atlantic Coastal Fisheries Center.
C. J. Sindermann.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 281-301, 1976. 3 fig, 109 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Fish, *Fisheries, *Water pollution effects, *Environmental effects, Heavy metals, Halogenated pesticides, Oil pollution, Sport fishing, *Outer Continental Shelf, New York Bight, Ocean dumping, Petroleum.

Industrial contamination of coastal waters exerts great local impact on fish and shellfish populations. Known offenders include heavy metals, halogenated hydrocarbons, and petroleum residues. Even in low concentrations, many industrial chemicals have profound effects on some or all life stages of marine animals; effects may be reflected in mortality, increased occurrence of abnormalities, and physiological disturbances, with resultant slow growth or spawning inhibition. Orderly development of marine aquaculture in coastal waters can be severely impeded by contaminant-related public health problems, both chemical and microbial, and by contaminant-induced problems associated with survival, reproduction, and growth of cultivated animals. Long term effects on sportfish abundance are difficult to quantify. Available evidence suggests that environmental stress may precipitate diseases in fish and shellfish. Public health aspects are presently confined largely to those microorganisms and toxic substances which do not produce obvious disease in fish and shellfish--but which may be accumulated or transmitted passively to humans from aquatic animal vectors (hepatitis, cholera, typhoid, and mercury poisoning). A few pathogens of fish and shellfish may be transmissible to humans, but a clear role for pollutant effects has not been demonstrated. Evidence exists for localized effects on fisheries, but there is as yet little specific evidence of widespread damage to major fisheries resource populations result from coastal pollution. (Sinha-OEIS)
W79-05699

MIDDLE ATLANTIC FISHERIES: RECENT CHANGES IN POPULATIONS AND OUTLOOK,
National Marine Fisheries Service, Woods Hole, MA. Northeast Fisheries Center.
R. L. Edwards.
In: 'Middle Atlantic Continental Shelf and the New York Bight'. Proceedings of symposium, NY, 3-5 Nov. 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Vol. 2, p 302-311, 1976. 7 fig, 2 tab, 18 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Fisheries, *Population, *Baseline studies, *Surveys, Ecosystems, Water resources, Environmental effects, *Outer Continental Shelf, *New York Bight.

Groundfish survey data from 1963-1965 show that about 22% of the available finfish fishery resources were being harvested. In 1964-1967, standing crops decreased about 40%, indicating that harvesting was at near the maximum rate. All fishery resources were nearly depleted by 1975. Bringing back certain species to traditional levels of abundance would require reducing catches of other species so low as to create more serious problems. The ICNAF 'second tier quota,' or biomass approach, evolved from the need to deal effectively with these problems. It is essential that the factors influencing recruitment be determined; these factors may be more density independent than many suppose. The concept of maximum sustainable yield ignores these factors. (Sinha-OEIS)
W79-05700

SOME RESULTS OF FISH SURVEYS IN THE MID-ATLANTIC IMPORTANT FOR ASSESSING ENVIRONMENTAL IMPACTS,
National Marine Fisheries Service, Woods Hole, MA. Northeast Fisheries Center.
M. D. Grosslein.
In: 'Middle Atlantic Continental Shelf and the NY. Bight'. Proceedings of symposium, held in NY., NY on 3-5 Nov. 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Vol. 2, p 312-328, 11 fig, 1 tab, 10 ref.

Descriptors: *Water pollution effects, *Fish, *Surveys, *Environmental effects, Baseline studies, Resources development, Waste disposal, Ecosystems, *Outer Continental Shelf, *New York Bight.

Knowledge of the distribution, biomass, and composition of the major biological communities is essential to the data base required for assessing the impact of environmental change on the marine ecosystem. Since 1967 the National Marine Fisheries Service has conducted regular trawl surveys in the mid-Atlantic, providing quantitative measures of density distributions of demersal fish populations. The surveys show that each species occupies wide areas of the shelf and that there is a high degree of species mixture, particularly in the New York Bight. Significant numbers of adult stages, planktonic eggs, and larvae can be found over the whole mid-Atlantic shelf all year. Thus there are no shelf areas free of risk from potential damage from waste disposal activities. Impacts of any change must consider a multispecies community and include all life stages. Precision of large-scale surveys is relatively low, making it difficult to detect any but major changes. Broad-scale surveys must be augmented with detailed laboratory and field experiments on physiology and behavior (especially food chains) of selected organisms and communities to get insight into probable effects of sublethal factors. The complexity and scope of marine ecosystems require long term but well coordinated research programs to ensure proper integrations of small-vs. large-scale studies and field vs. laboratory experiments. (Sinha-OEIS)
W79-05701

FIN ROT DISEASE STUDIES IN THE NEW YORK BIGHT,
National Marine Fisheries Service, Oxford, MD. Middle Atlantic Coastal Fisheries Center.
R. A. Murchelano, and J. Ziskowski.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 329-335, 1976. 3 fig, 3 tab, 8 ref. Allen Press, Inc., Lawrence, Kansas.

Descriptors: *Fish diseases, *Water pollution effects, *Environmental effects, Bottom sediments, Sediments, Sewage sludge, *Outer Continental Shelf, *New York Bight, *Fin rot disease, Flatfish, Flounder, Pseudopleuronectes americanus, Paralichthys dentatus.

Surveys from February 1974 through June 1975 showed the prevalence of fin rot disease in winter flounder (Pseudopleuronectes americanus) from the New York Bight apex was 3.9%, compared to 0.7% outside the apex. Prevalence of the disease in winter flounder from apex areas of low carbon deposits was 2.9%; whereas, in apex areas of high carbon deposits, disease prevalence was 5.1%. The prevalence of fin rot disease in summer flounder (Paralichthys dentatus) from the apex was 0.5% and in summer flounder from Sandy Hook-Raritan Bay was 3.4%. No summer flounder with fin rot were noted in Great Bay, a control area outside the apex. Although the numbers of diseased fish are small, incidence of fin rot disease in summer flounder from Sandy Hook-Raritan Bay increased monthly from June-November 1974. Attempts to induce fin rot disease in winter flounder in cages submerged in the sewage sludge area of the bight apex produced active fin lesions on the caudal fins more often than on the dorsal and anal fins. These flounder were in substantially worse condition than fish in cages at the control site. (Sinha-OEIS)
W79-05702

CHROMOSOME MUTAGENESIS IN DEVELOPING MACKEREL EGGS SAMPLED FROM THE NEW YORK BIGHT,
National Marine Fisheries Service, Milford, CT. Experimental Biological Investigations.
A. C. Longwell.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 337-339, 1976. 1 fig, 8 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Fish eggs, *Heavy metals, *Water pollution effects, Pesticides, Cadmium, Environmental effects, *Outer Continental Shelf, *New York Bight, *Mutagenesis, *Chromosome mutagenesis, Mackerel eggs.

Certain heavy metals and pesticides are recognized mutagens and, along with some other major classes of marine contaminants, may have important implications in survival of fish populations. This may be particularly so for fish using the polluted New York Bight as spawning grounds. Mutagens can cause genetic damage at subtoxic levels. Many marine contaminants accumulate in the body tissues of fish and other marine species. Cadmium has been shown to be absorbed from seawater by post-spawned fish eggs. The chromosomes of developing fish eggs provide a sensitive test for genetically active substances, both experimentally and in polluted natural waters. Any new determination of mortality of early fish stages, irrespective of its cause, would have important bearing on the general theories of fluctuations of fish populations and on predictions of success of any year class of commercial fish. Two stations just south of Long Island were among those with the lowest incidences of chromosomes aberrations and mitotic irregularities. A third station farther up the Long Island coast had a slightly higher incidence. The station with the highest mean off the New Jersey coast was the only one with any significant observable mortality. On the basis of cell contrast and deterioration of the nuclei, 20 of 76 embryos (26%) were already dead. There was not yet any gross deterioration of the embryo or egg. Also, there were more instances of multiple chromosome abnormalities within mitosing cells of embryos from this station. (Sinha-OEIS)
W79-05703

BACTERIAL FLUX IN SOME NEW JERSEY ESTUARINE SEDIMENTS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Microbiology; and Rutgers - The State Univ., New Brunswick, NJ. Marine Sciences Center.
For primary bibliographic entry see Field 2L.
W79-05704

SEABED OXYGEN CONSUMPTION--NEW YORK BIGHT APEX,
National Marine Fisheries Service, Highlands, NJ. Middle Atlantic Coastal Fisheries Center.
J. P. Thomas, W. C. Phoel, F. W. Steimle, J. E. O'Reilly, and C. A. Evans.
In: 'Middle Atlantic Continental Shelf and New York Bight', Proceedings of symposium, NY on 3-5 Nov. 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Vol. 2, p 354-369, 1976. 7 fig, 4 tab, 40 ref.

Descriptors: *Waste disposal, *Water pollution effects, *Oxygen, Benthos, Environmental effects, Sediment, Sewage sludge, Industrial wastes, *Outer Continental Shelf, *New York Bight, *Ocean dumping, *Oxygen uptake, Dredge spoil.

Seabed oxygen consumption rates, temperature, salinity, and dissolved oxygen were measured during five cruises in the New York Bight apex

between March 1974 and August 1975. The area sampled included the waste disposal sites for sewage sludge, dredge spoils, and industrial acid wastes. Samples were collected and incubated on shipboard at in situ temperature during oxygen uptake measurements. In winter the highest rates of uptake were measured in the Christiaensen Basin adjacent to the sewage sludge disposal site, in the topographically high dredge spoil disposal area west of the Christiaensen Basin, and in the Hudson Shelf Valley. In summer the highest rates were measured in the dredge spoil area. Rates in the Christiaensen Basin, however, were low compared with the surrounding areas and were more like winter rates. This difference may have been caused by differential sedimentation rates of oxidizable organic carbon to the seabed, mediated by the presence or absence of a thermocline. The highest rates were measured near a municipal sewage outfall off Asbury Park, N.J. No discernible effects on seabed oxygen consumption were observed near the acid waste disposal area. Rates of oxygen uptake by the bottom water and by the entire water column were measured and compared with oxygen uptake rates by the sediment. Most (93%-98%) oxygen uptake in the apex occurs in the water column and not on the seabed. (Sinha-OEIS)
W79-05705

BENTHIC-PELAGIC COUPLING IN THE NEW YORK BIGHT,
Woods Hole Oceanographic Institution, MA.
G. T. Rowe, K. L. Smith, Jr., and C. H. Clifford.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 370-376. 3 fig, 1 tab, 25 ref. Allen Press, Inc., Lawrence, Kansas.

Descriptors: *Bottom sediments, *Waste disposal, Sewage sludge, *Water pollution effects, Baseline studies, Ecosystems, Nutrients, Oxygen, *Outer Continental Shelf, *New York Bight, Ocean dumping.

Bottom sediment oxygen consumption can be used to estimate how much of the energy incorporated by the phytoplankton is utilized by the benthos, and such rates are directly related to temperature, organic matter in the sediment, availability of dissolved oxygen, and primary production in the water column. Nutrient flux out of sediments has been measured directly by incubating areas of bottom under bell jarlike chambers. Fluxes of major inorganic plant nutrients are often high, indicating that in most nearshore environments most regeneration occurs on the bottom. In the New York Bight, oxygen consumption by the bottom was measured in four different seasons; we concluded it was high enough to oxidize a large fraction of the daily input of sludge. Bottom water ammonia gradients suggested too that remineralization rates were high on the bottom in the bight. Samples taken in August 1975, in Christiaensen Basin, along with measurements in situ of ammonia flux from the bottom, confirmed that the sediments enriched by sewage sludge are regenerating nutrients but at that time not at rates as high as our earlier predicted rates for the mid-Atlantic Bight. (Sinha-OEIS)
W79-05706

BENTHIC COLONIZATION PROCESSES--A REVIEW AND A PROPOSED NEW MODEL,
Rhode Island Univ., Kingston. Dept. of Mathematics; and Rhode Island Univ., Kingston. Graduate School of Oceanography.
J. S. Papadakis, and S. B. Saila.
In: 'Middle Atlantic Continental Shelf and Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 377-382, 1976. 5 fig, 1 tab, 16 ref. Allen Press Inc., Lawrence, Kansas. URI 98-19-3135L , 98-00-8025.

Descriptors: *Benthos, *Models, *Water pollution effects, Environmental effects, Baseline studies, *Outer Continental Shelf, *New York Bight, Ocean dumping, Colonization.

The new model proposed here is based on the assumption of a constant environment or a priori knowledge of its dependence on time and recruitment into the area by motile juvenile forms. The model can accommodate any number of species for which data are available. The above assumptions are formulated into a linear immigration death process. To model species interactions, the immigration rate of each species is assumed to be a function of the total biomass in the area at time t and the carrying capacity. The distribution of the number of individuals in a species is assumed to be approximated by a Poisson distribution. The model was implemented on a digital computer. The required input parameters are the initial number, immigration rate, death rate, and average biomass of organisms by species. An estimate of the environmental carrying capacity is also required. The relatively great data requirements have limited further empirical testing, nevertheless, it is the best available tool for better understanding and predicting recovery from catastrophic events.(Sinha-OEIS)
W79-05707

ANTIMICROBIAL RESISTANT BACTERIA IN THE NEW YORK BIGHT,
Montclair State Coll., Upper Montclair, NJ. Dept. of Biology.
L. Koditschek.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceeedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 383-393, 1976. 1 fig, 7 tab, 41 ref. Allen Press, Inc. Lawrence, Kansas. NOAA-N-043-48-72.

Descriptors: *Bacteria, *Mercury, *Antibiotics(Pesticides), *Sediments, Coliforms, Water pollution effects, Environmental effects, *Outer Continental Shelf, *New York Bight, Ocean dumping.

Sediment samples and overlying water from stations around the sewage dump site in the New York Bight were analyzed for coliform and noncoliform bacteria resistant to mercury and antibiotics. Few or no coliforms could be found in these samples, but a pollution gradient was identified in a northeasterly direction, toward Long Island. About 1% of the sediment bacteria desorbed was consistently resistant to HgC1210-3M and/or tetracycline 40 mcg/ml at MESA station 34. The antibiogram of a majority of the isolates from these sediments showed multiple antibiotic resistance. Sediments from which antimicrobial resistant bacteria were isolated had high bound water content, much debris, little or no evidence of normal benthic macrofauna and a black, gelatinous consistency. In contrast, sediment taken from the Sandy Hook transect showed no resistant bacteria, and demonstrated no other parameters related to pollution. Analysis of water and sediments containing very small numbers of coliforms from a beach at Sandy Hook State Park revealed a significant number of bacteria resistant to seven or more antibiotics. These data suggest that techniques used in these studies may detect pollution gradients which are not measurable by coliform counts. (Sinha-OEIS)
W79-05708

TEMPORAL AND SPATIAL DISTRIBUTIONS OF BENTHIC MACROINVERTEBRATES IN THE NEW YORK BIGHT,
National Marine Fisheries Service, Highlands, NJ. Middle Atlantic Coastal Fisheries Center.
J. B. Pearce, J. V. Caracciolo, M. B. Halsey, and L. H. Rogers.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 394-403, 1976. 4 fig, 1 tab, 38 ref. Allen Press, Inc., Lawrence, Kansas.

Descriptors: *Temporal distribution, *Spatial distribution, *Benthos, Water pollution effects, Environmental effects, Baseline studies, *Outer Continental Shelf, *New York Bight, Ocean dumping, Organic carbon.

Benthic biota in the New York Bight apex is characterized by high spatial and temporal variability. A considerable reduction in numbers of individuals per sample was observed between August 1973 and August 1974; on an average, numbers of individuals per sample was observed between August 1973 and August 1974; on an average, numbers of individuals per station decreased from 417 to 174. Low species diversity was observed at some stations inside the Christiaensen Basin, an area characterized by high organic carbon values in sediment. Certain species, apparently tolerant of carbon-rich deposits of the Christiaensen Basin, were extremely abundant at some stations located in the basin. These included the anemone Cerianthus, four species of polychaete, and the bivalve Nucula. (Sinha-OEIS)
W79-05709

DISTRIBUTION AND ABUNDANCE OF INSHORE POPULATIONS OF THE SURF CLAM SPISULA SOLIDISSIMA,
Brooklyn Coll., New York. Dept. of Biology.
D. R. Franz.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, NY on 3-5 Nov. 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc., Special symposia, Vol. 2, p 404-413, 1976. 8 fig, 1 tab, 12 ref. NOAA/NMFS 03-4-043-355.

Descriptors: *Clams, *Water pollution effects, Environmental effects, Baseline studies, Waste disposal, Distribution, *Outer Continental Shelf, New York Bight, Ocean dumping, Spisula solidissima.

The distribution and abundance of juvenile and adult surf clams were determined inshore of the 3-mi contour in July 1974 at 141 sites off Long Island, New York. Transects were located every 2 mi from Montauk to Rockaway Point, and samples were taken at 0.5, 1.5, and 2.5 mi offshore. Selected stations were revisited in July 1975. East of Shinnecock Inlet adult clams occurred at densities between 0.5 and 3.0 bushels per dredge haul. West of Shinnecock adults declined gradually, reaching a minimum west of Jones Inlet to East Rockaway Inlet. Abundances increased precipitously off Rockaway Beach. Highest densities of juveniles occurred at 0.5 mi and decreased rapidly farther offshore. Juveniles were more abundant at the west end of Long Island, particularly inshore at 0.5 mi. Higher densities of juveniles here may result from accumulation of larvae produced farther east and transported westward via longshore currents. The convergence of tidal and longshore currents may effectively 'trap' larvae off western Long Island. Clam stocks off eastern Long Island probably are older than 9 years and are mostly composed of 1-3 age classes. Clam stocks off the Rockaways appear younger. The commercial fishery is apparently dependent on massive settlements of larvae occurring irregularly and infrequently. (Sinha-OEIS)
W79-05710

INFECTIOUS DISEASES IN COMMERCIAL SHELLFISH ON THE MIDDLE ATLANTIC COAST,
National Marine Fisheries Service, Oxford, MD. Middle Atlantic Coastal Fisheries Center.
A. Rosenfield.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Vol. 2, p 414-423, 1976. 71 ref. Allen Press, Inc. Lawrence, Kansas.

Descriptors: *Water pollution effects, *Shellfish, *Waste disposal, *Oil spills, *Fish diseases, Polychlorinated biphenyls, Crustaceans, Mollusks, Environmental effects, Clams, Crabs, Lobsters, Shrimp, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Mya arenaria.

Proliferative cell conditions in marine shellfish have been reported with increased frequency recently and neoplasias of molluscs in epizootic proportions have been reported from both U.S. coasts. Gonadal neoplasms in soft-shell clams (Mya arenaria) have been found in areas associated with oil spills. Studies of benthic crustaceans from Sandy Hook Bay and the New York Bight show that the parasitic amoeba Paramoeba pernisiosa occurs in rock crabs Cancer irroratus and American lobsters Homarus americanus. Lobsters, shrimp, and rock crabs near sludge and spoil disposal grounds in the New York Bight had shell erosion and ulcers. Naturally occurring bacteremias in lobsters and blue crabs have been reported and may play a role in crustacean eipzootics. Virus-like infections in blue crabs from Chincoteague Bay have been recently been noted. Polychlorinated biphenyls may activate production of a Baculovirus in shrimp exposed to sublethal levels of these compounds. Viruses may be latent in shellfish and activated b the presence of certain chemicals. (Sinha-OEIS)
W79-05711

THE IMPACT OF POLLUTION ON MARINE BATHING BEACHES: AN EPIDEMIOLOGICAL STUDY,
Environmental Research Lab., Narragansett, RI.
V. J. Cabelli, A. P. Dufour, M. A. Levin, and P. W. Habermann.
In: Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 424-432, 1976. 4 fig, 3 tab, 20 ref. Allen Press Inc., Lawrence, Ks.

Descriptors: *Water pollution effects, *Water quality, *Beaches, Public health, Swimming, Coliforms, *Outer Continental Shelf, *New York Bight, Ocean dumping, Escherichia coli.

As part of a national program to develop health effects criteria for marine recreational waters, the U.S. Environmental Protection Agency conducted a prospective epidemiological-microbiological study at bathing beaches in the vicinity of New York City, specifically at 20th St. on Coney Island and 67th St. and Riis Park at the Rockaways. The most consistent findings over the first 2 years of this study were that, for most of the water quality indicators examined, the mean densities at the Coney Island beach were appreciably and significantly higher than those at the Rockaways, and that the rate of gastrointestinal (GI) symptoms was significantly higher among swimmers relative to nonswimmers at the Coney Island beach but not at the Rockaways. When the data from two summers at both beaches (four points) were examined, good agreement was obtained between the mean Escherichia coli and enterococcus densities and the differential (swimmers minus nonswimmers) rate of GI symptoms. This preliminary finding addresses the objective of the study: relating illness as measured by symptomatology to some indicator o water quality. (Sinha-OEIS)
W79-05712

SAFE SHELLFISH FROM THE SEA,
Food and Drug Administration, Davisville, RI. Shellfish Sanitation Branch.
J. L. Verber.
In: 'Middle Atlantic Continental Shelf and the New York Bight', Proceedings of symposium, held in New York, NY on 3-5 November 1975. M. Grant Gross (Ed.) American Society of Limnology and Oceanography, Inc. Special Symposia, Volume 2, p 433-441, 1976. 4 fig, 2 tab, 20 ref. Allen Press Inc., Lawrence, Kansas.

Descriptors: *Shellfish, *Public health, *Waste disposal, *Water pollution effects, Sewage sludge, Bacteria, Fish diseases, Environmental effects, *Outer Continental Shelf, *New York Bight, Ocean dumping, Dredge spoil, Typhoid.

The National Shellfish Sanitation Program was initiated in 1925 after a widespread typhoid fever outbreak caused by raw oysters. Specific recommendations made in 1925 established guidelines for classifying offshore waters for clam harvesting and stated that shellfish being harvested must not be exposed to fecal contamination. In 1974, sea clams accounted for 59% of all shellfish (oysters, clams, and mussels) harvested from United States waters. The Food and Drug Administration is responsible for classifying the offshore water beyond 5.5 km for harvesting shellfish. In recent years, the sea has been used increasingly for sewage sludge and industrial waste disposal. Depletion of the resources in the original major sea clam harvest area off New Jersey and increased demand (43 million kg were harvested in 1974) have caused the industry to expand its area of operation to the southeast in search of more productive shellfish beds. There too, heavy population and industrial growth have increased the amounts of chemical wastes, sewage sludge, and other waste materials being disposed of at sea. Warning notices to harvesters, closing areas of the New York Bight to shellfishing, have been posted since 1970. High bacterial levels are found in both the sewage sludge and dredge spoil sites. (Sinha-OEIS)
W79-05713

BIOMASS AND SPECIES RICHNESS OF THE MACROBENTHIC ANIMALS LIVING ON THE TIDAL FLATS OF THE DUTCH WADDEN SEA: LONG-TERM CHANGES DURING A PERIOD WITH MILD WINTERS,
Nederlands Inst. voor Onderzoek der Zee, Texel.
J. J. Beukema, W. De Bruin, and J. J. M. Jansen.
Netherlands Journal of Sea Research, Vol. 12, No. 1, p 58-77, 1978.

Descriptors: *Biomass, *Wadden Sea(Netherlands), *Species richness, *Benthic fauns, *Tidal flats, *Cold resistance, Seas, Netherlands, Clams, Mussels, Worms, Mollusks, Bivalves, Faunal lists, Winter, Recruitment, Temperature, Mya arenaria, Arenicola marina, Macoma balthica, Mytilus edulis, Angulus tenuis, Lanice conchilega, Nephtys hombergii.

Total biomass estimates were similar but species composition different in 1971-72 and 1977 studies of macrobenthic fauna on the tidal flats of the western half of the Wadden Sea, the Netherlands. Mya arenaria (gaper clam), Arenicola marina (lugworm), and Macoma balthica (tellinid clam) declined significantly, while biomass of Mytilus edulis (mussel), Lanice conchilega (tube-building worm), Nephtys hombergii (worm), and Angulus tenuis (tellinid bivalve) increased. Species density increased, both as higher total number of species and by increased frequency of occurrence of Angulus tenuis and L. conchilega. Declines were attributed primarily to failing recruitment, and increases to better survival during mild winters over the study period. Of 49 transects sampled in 1971-72, 48 were again sampled in 1977. Along each one-km transect 25 cores of 0.018 sq m and 30-40 cm deep were taken and sieved through a one-mm sieve. Animals were counted and ash-free dry weight estimated for each species in each transect. Species richness (number of species in pooled samples along a transect) was 10% higher in 1977 than in 1971-72. Forty-two species were identified in the second survey, compared with 34 during the first (only three of which were not found in 1977), but the 11 new species accounted for less than half of the increase in species density. (Lynch-Wisconsin)
W79-05718

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS, PART I. SUMMARY,
Battelle Pacific Northwest Lab., Richland, WA.
A. Brandstetter, R. G. Baca, A. F. Gasperino, and A. S. Myhers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 912, Price codes: A03 in paper copy, A01 in microfiche. Report January 1977. 22 p, 13 fig, 1 tab, 7 ref.

Descriptors: *Computer models, *Adelaide(Australia), *Reservoirs, *Water supply, *Eutrophication, *Water pollution effects, *Lake restoration, *Mt. Bold Reservoir(Australia), Model studies, Australia, Limnology, Lakes, Municipal water, Algae, Biochemical oxygen demand, Dissolved oxygen, Ecology, Cycling nutrients, Phosphorus, Nutrients, Land use, Water management(Applied), Lake Washington(WA), Washington, Computer programs, Mathematical models, Trophic levels, Chlorophyll, Secchi disks.

This volume summarizes a project to develop eutrophication model and a limnological model to predict and simulate eutrophication and other water quality changes in the municipal water supply reservoirs of Adelaide, Australia, and to evaluate the effectiveness of lake restoration schemes. Three other volumes cover: (1) model formulation, calibration, and verification; (2) user's manual; and (3) Mt. Bold Reservoir data acquisition and evaluation. The detailed limnological model predicts daily changes of all important water quality phenomena, including thermal stratification, dissolved oxygen, nutrient cycling, and algal growth and decay, over several seasons (less than 10 years). The eutrophication model, which requires minimal data, can predict monthly changes in key trophic indicators over many years (10 or more). Two models together provide the information necessary for assessing detailed short-term water quality fluctuations and general long-term eutrophication trends resulting from alternative land use and lake management plans. The eutrophication model was tested with data from Lake Washington (Washington) for 1933-72, with good agreement. The limnological model was tested with data from Mt. Bold Reservoir near Adelaide for 1973-75, with good results for all parameters except suspended sediment, for which there was not sufficient data. The models were programmed in Fortran IV. (See W79-05729 thru W79-05731) (Lynch-Wisconsin)
W79-05728

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS. PART 2. MODEL FORMULATION, CALIBRATION AND VERIFICATION,
Battelle Pacific Northwest Lab., Richland, WA.
R. G. Baca, A. F. Gasperino, A. Brandstetter, and A. S. Myhres.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 913, Price codes: A07 in paper copy, A01 in microfiche. Report January 1977. 122 p, 28 fig, 11 tab, 33 ref, 1 append.

Descriptors: *Computer models, *Reservoirs, *Adelaide(Australia), *Eutrophication, *Limnology, *Water supply, *Water pollution effects, *Lake restoration, *Mt Bold Reservoir(Australia), Model studies, Mathematical models, Lakes, Australia, Municipal waters, Algae, Biochemical oxygen demand, Dissolved oxygen, Lake Washington(WA), Sediment-water interfaces, Cycling nutrients, Phosphorus, Nitrogen, Washington, Trophic level, Forecasting, Phytoplankton, Zooplankton, Chlorophyll, Secchi disks, Water management(Applied).

Formulations, calibration, and verification of a eutrophication model and a limnological model for predicting and simulating water quality changes in municipal water supply reservoirs of Adelaide, Australia, are described. These computer models apply to both shallow and deep lakes and reservoirs. The eutrophication model incorporates inflows and outflows, fluctuations of the thermocline, nutrient fixation and mineralization, and sediment-water interactions to simulate monthly changes of four eutrophication indicators: (1) soluble phosphorus, (2) total phosphorus, (3) chlorophyll-a, and (4) Secchi disc depth. The limnological model is based on dynamics of heat and mass transport, hydromechanics, and chemical and biological transformations. The model simulates daily vertical and horizontal variations of: (1) water flow

and temperature, (2) phytoplankton and zooplankton biomass, (3) nitrogen and phosphorus forms, (4) BOD, (5) DO, (6) total dissolved solids, and (7) suspended sediments. The eutrophication model was verified with data from Lake Washington (Washington) for 1933-72, which showed its ability to predict changes in lake trophic state, and the limnological model was tested with data from Mt. Bold Reservoir near Adelaide for 1973-75 with good results, except for suspended sediment for which data were insufficient. Three other volumes provide a summary of the project, a user's manual, and Mt. Bold Reservoir data acquisition and evaluation. (See also W79-05728) (Lynch-Wisconsin)
W79-05729

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS. PART 3. USER'S MANUAL,
Battelle Pacific Northwest Labs., Richland, WA.
R. G. Baca, A. S. Myhres, A. Brandstetter, and A. F. Gasperino.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 914, Price codes: A05 in paper copy, A01 in microfiche. Report January 1977. 83 p, 6 fig, 24 tab, 43 ref.

Descriptors: *Computer models, *Manuals, *Reservoirs, *Eutrophication, *Limnology, *Water pollution effects, *Lake restoration, *Mt Bold Reservoir(Australia), Adelaide(Australia), Australia, Model studies, Mathematical models, Computer programs, Lakes, Biochemical oxygen demand, Dissolved oxygen, Cycling nutrients, Phosphorus, Nitrogen, Phytoplankton, Zooplankton, Algae, Trophic level, Forecasting, Chlorophyll, Secchi disks, Water quality, Biomass, Dissolved solids, Suspended sediments, Water management(Applied).

A manual gives detailed user's instructions for two mathematical models developed to predict and simulate eutrophication and other water quality changes in municipal water supply reservoirs of Adelaide, Australia. The eutrophication model and limnological model apply to both deep and shallow lakes and reservoirs. This manual provides detailed input instruction, an explanation of required input data, and samples of model input and output. The eutrophication models predicts monthly average changes in lake trophic state in terms of soluble and total phosphorus, chlorophyll-a, and Secchi disc depth over many years (10 or more). The computer program of this model is written as one main program. The limnological model predicts daily horizontal and vertical flow and water quality patterns over short-term periods (less than 10 years), simulating water flow and temperature, phytoplankton and zooplankton biomass, nitrogen and phosphorus forms, BOD, DO, total dissolved solids, and suspended sediments. The computer program of this model consists of four main sub programs coupled by common input and output, and run in sequence. The models were verified with data from Lake Washington (Washington) and from Mt. Bold Reservoir near Adelaide. Three other volumes provide a summary of the project; model formulation, calibration, and verification; and Mt. Bold Reservoir data acquisition and evaluation. (See also W79-05728) (Lynch-Wisconsin)
W79-05730

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS. PART 4. MT. BOLD RESERVOIR DATA AQUISITION AND EVALUATION,
Battelle Pacific Northwest Labs., Richland, WA.
A. F. Gasperino, A. Brandstetter, A. S. Myhres, and R. G. Baca.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 915, Price codes: A05 in paper copy, A01 in microfiche. Report January 1977. 82 p, 81 fig, 7 tab, 8 ref.

Descriptors: *Mt Bold Reservoir(Australia), *Water supply, *Computer models, *Municipal water, *Adelaide(Australia), *Limnology, Data collections, Calibration, Verification, Reservoirs, Australia, Model studies, Mathematical models, Eutrophication, Meteorological data, Lake morphometry, Water quality, Data processing, Algae, Biochemical oxygen demand, Dissolved oxygen, Water pollution effects, Ecology, Lake restoration, Onkaparinga River(Australia), Echunga Creek(Australia), Rivers, Streams, Water management(Applied).

Data from Mt. Bold Reservoir, part of the municipal water supply system of Adelaide, Australia, used in calibrating and verifying a computerized limnological model are documented and evaluated. The limnological model and an accompanying eutrophication model were developed for predicting and simulating water quality changes in Adelaide's water supply reservoirs. Data pertain to water flow, water quality, meteorology, and morphometry of the reservoir. Data were plotted with existing computer programs to examine consistency and accuracy, and to study spatial and temporal trends. Evaluation results indicated a need for additional field measurements, and a data acquisition program is recommended to provide data needed for future model applications. Verification of the limnological model with data from 1973-75 indicated good results except for suspended sediment, for which data were insufficient. Effects of salinity and color on algal growth could not be simulated due to lack of inflow and lake data, and data were likewise inadequate to calibrate the eutrophication model, which was therefore tested with data from Lake Washington (Washington). Three other volumes provide a summary of the entire project; model formulation, calibration, and verification; and a user's manual. (See also W79-05728) (Lynch-Wisconsin)
W79-05731

A COMPENDIUM OF LAKE AND RESERVOIR DATA COLLECTED BY THE NATIONAL EUTROPHICATION SURVEY IN THE CENTRAL UNITED STATES.
Working Paper No 476, September 1978; U.S. Environmental Protection Agency, Corvallis Environmental Research Laboratory, Oregon. 199 p.

Descriptors: *National Eutrophication Survey, *Eutrophication, *Lakes, *Reservoirs, *Data collections, *Central US, Great Plains, Nutrient loading, Lake morphometry, Limnology, Trophic level, Phytoplankton, Algae, Limiting factors, Nutrients, Point pollution, Nonpoint pollution, Nitrogen, Phosphorus, Water chemistry, Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, Texas.

Morphometric, limnological, and nutrient loading data collected in 1974 during EPA's National Eutrophication Survey are summarized for 182 lakes and reservoirs in the central and plains states. States included: Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas. A brief introduction describes data collection methodology. Data are arranged in five categories for each body of water: (1) morphometry, (2) physical and chemical characteristics, (3) biological characteristics, (4) nutrient loading, and (5) nonpoint source nutrient export. A trophic level designation is also given (oligotrophic, mesotrophic, eutrophic, or hypereutrophic). Morphometric data include drainage and surface area, mean depth, total inflow, and retention time. Physical/chemical characteristics include median alkalinity, conductivity, total phosphorus, orthophosphorus, inorganic nitrogen, and total nitrogen, and mean Secchi disc depth. Biological characteristics include mean chlorophyll-a, algal assay control yield, limiting nutrient, and a count of phytoplankton by genera. Nutrient loading data include phosphorus and nitrogen input (municipal), industrial, and septic tank point sources, nonpoint sources, and total loading) and output (outlet, percent retention, and lake surface area loading rate. Nonpoint source nutrient export includes (by specific stream): mean flow, drainage area, mean total phosphorus and nitrogen, and total phosphorus and nitrogen export. (Lynch-Wisconsin)
W79-05732

A COMPENDIUM OF LAKE AND RESERVOIR DATA COMPILED BY THE NATIONAL EUTROPHICATION SURVEY IN THE WESTERN UNITED STATES.
Working Paper No 477, September 1978; U.S. Environmental Protection Agency, Corvallis Environmental Research Laboratory, Oregon. 168 p.

Descriptors: *National Eutrophication Survey, *Eutrophication, *Lakes, *Reservoirs, *Data collections, *Southwest US, *Rocky Mountain Region, Pacific Coast Region, Nutrient loading, Lake morphometry, Limnology, Trophic level, Phytoplankton, Algae, Limiting factors, Nutrients, Point pollution, Nonpoint pollution, Nitrogen, Phosphorus, Water chemistry, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

Morphometric, limnological, and nutrient loading data collected in 1975 during EPA's National Eutrophication Survey are summarized for 136 lakes and reservoirs in the Rocky Mountain and far-western states. States included: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. A brief introduction describes data collection methodology. Data are arranged in five categories for each body of water: (1) morphometry, (2) physical and chemical characteristics, (3) biological characteristics, (4) nutrient loading, and (5) nonpoint source nutrient export. A trophic level designation is also given (oligotrophic, mesotrophic, eutrophic, or hypereutrophic). Morphometric data include drainage and surface area, mean depth, total inflow, and retention time. Physical/chemical characteristics include median alkalinity, conductivity, total phosphorus, orthophosphorus, inorganic nitrogen, and total nitrogen, and mean Secchi disc depth. Biological characteristics include mean chlorophyll-a, algal assay control yield, limiting nutrient, and a count of phytoplankton by genera. Nutrient loading data include phosphorus and nitrogen input (municipal), industrial, and septic tank point sources, nonpoint sources, and total loading) and output (outlet, percent retention, and lake surface area loading rate. Nonpoint source nutrient export includes (by specific stream): mean flow, drainage area, mean total phosphorus and nitrogen, and total phosphorus and nitrogen export. (Lynch-Wisconsin)
W79-05733

A PHOSPHORUS BUDGET FOR LAKE BURLEY GRIFFIN AND MANAGEMENT IMPLICATIONS FOR URBAN LAKES,
P. Cullen, R. Rosich, and P. Bek.
Australian Water Resources Council, Technical Paper No 31, 1978, Research project No 75/92. 220 p, 35 fig, 88 tab, 252 ref, 3 append.

Descriptors: *Urban lakes, *Lake Burley Griffin(Australia), *Phosphorus, *Nutrient budgets, *Eutrophication, *Water pollution control, *Aquatic weed control, *Water pollution sources, *Water quality control, Lakes, Australia, Canberra(Australia), Nutrients, Zinc, Sewage disposal, Primary productivity, Limiting factors, Algae, Phytoplankton, Macrophytes, Light penetration, Turbidity, Wetlands, Molonglo River(Australia), Queanbeyan River(Australia), Urban runoff, Agricultural runoff, Sedimentation, Flooding, Artificial lakes, Urban hydrology, Water management, Mechanical control.

A phosphorus budget was constructed for Lake Burley Griffin in Canberra, Australia, contaminated by runoff and treated sewage from the upstream city of Queanbeyan, and by agricultural drainage. The lake can be classified eutrophic based on nutrient content and algal and macrophyte species, but primary productivity is limited by turbidity-restricted light penetration by turbidity (a view supported by Vollenweider's phosphorus-loading model), and possibly by zinc pollution, which modifies the eutrophic classification. Completion of the Googong Dam and Captains Flat pollution control works may eliminate these productivity limitations through restriction of sediment movement and reduction of zinc pollution. Phosphorus forms were measured weekly 1975-77 at 13 station

and upstream and downstream in the lake. Conclusions: (1) floods contributed 69% of total phosphorus, and 90% of flood phosphorus came from nonurban agricultural and forest lands; (2) Queanbeyan sewage effluent contributed 72% of phosphorus during normal periods and 90% during droughts; (3) urban runoff contributed only 3.5% of total phosphorus (3% of the watershed is urbanized); and (4) phosphorus export ranged from 0.91 kg P/ha/yr in the Canberra urban area to 0.26 kg in the Queanbeyan River watershed. Recommendations: (1) replace most herbicide spraying of macrophytes with harvesting, (2) conserve adjacent wetlands for nutrient control, (3) divert dry-weather Molonglo River flow through basins supporting macrophytes, (4) utilize Queanbeyan sewage effluent for agricultural irrigation, and (5) use caution in applying phosphorus fertilizers to surrounding parks. (Lynch-Wisconsin)
W79-05734

THE CULTURE OF THE DIATOM CHAETOCEROS GRACILIS AND ITS USE AS A FOOD FOR PENAEID PROTOZOEAL LARVAE,
Oceanic Inst., Waimanalo, HI.
C. M. Simon.
Aquaculture, Vol 14, No 2, p 105-113, June 1978. 3 fig, 2 tab, 12 ref.

Descriptors: *Chaetoceros gracilis, *Diatoms, *Aquiculture, *Shrimp, *Penaeus stylirostris, *Penaeus vannamei, Chrysophyta, Protozoa, Larvae, Algae, Food chains, Costa Rica, Methodology, Cultures, Foods, Water temperatures, Nutrients, Eutrophication, Mortality.

The solitary diatom Chaetoceros gracilis has been successfully cultured as exclusive food for larvae of the protozoans Penaeus styliroostris and P. vannamei, used to feed shrimp at a commercial hatchery in Costa Rica. High larval survival rates (79.3-84.8%) were obtained in 40-cu m tanks. C. gracilis grew vigorously in hatchery tanks at 28-30C. Techniques were developed to prevent excessive diatom concentrations (over 100,000 cells/ml) which upon collapse caused mass larval mortality, and to prevent inadequately low concentrations (under 30,000 cells/ml) which also killed larvae. Control procedures include: (1) deliberate collapse before stocking, which limits but does not prevent further growth; and (2) simultaneous inoculation and stocking. Diatom levels up to 450,000 cells/ml were suitable for Penaeus growth, but above 100,000 cells/ml there was great risk of mortality due to algal collapse. Skeletonema costatum use has been declining in recent years in Japanese hatcheries because of difficulties in maintaining the species in larval cultures above 25C, and the occasional predominance of unsuitable diatom species. Stock solutions of C. gracilis were maintained in modified Guillard and Ryther medium f at 25-26C, without agitation or aeration. New cultures were inoculated after 3-4 days and aerated 3-4 days until a cell count of 3-4 million/ml was reached. Stock solutions were maintained one year without apparent contamination or loss of vigor. (Lynch-Wisconsin)
W79-05738

MATHEMATICAL MODEL AND COMPUTER SIMULATION OF THE POPULATION DYNAMICS OF ZOOPLANKTON IN LAKE AND ESTUARY ECOSYSTEMS,
Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
E. V. Kalmaz.
Ecological Modelling, Vol 5, No 3, p 225-235, September 1978. 1 fig, 20 ref.

Descriptors: *Lales, *Estuaries, *Zooplankton, *Computer models, *Simulation analysis, *Population dynamics, Mathematical models, Ecosystems, Survival, Food balance, Methodology, Life span, Analytical techniques, Food chains.

A mathematical model represents population dynamics and survival probabilities of zooplankton in lake and estuarine ecosystems. Basic digital computer simulation methodology is used for systematic application of the model to analyze zooplankton population dynamics. In analysis of this theoretical modelling, attention is focused on the animal's production and destruction processes, both of which are assumed to be stationary. The birth (production) rate is constant and life span distribution is independent of time. It is also assumed that different species are independent, that they share a common aquatic ecosystem, and that what happens to one species sophisticated methods of quantitative analysis to the species is the ultimate solution of food balance problems in an aquatic ecosystem. The fundamental features for the mathematical model and formulations used in predicting distribution and population survival of zooplankton in lakes and estuaries cannot be applied to open ocean systems because the latter have no definable boundaries and cannot be experimentally controlled or manipulated. The direct simulation in this study covers small time increments, dividing the population of zooplankton into small subpopulations, which can be summed to determine total population or the destruction of zooplankton, at a given time. (Lynch-Wisconsin)
W79-05739

INFLUENCE OF NON-POINT POLLUTION SOURCES IN CONNECTION WITH THE TUY RIVER BASIN SANITATION STUDIES,
Universidad Central de Venezuela, Caracas.
For primary bibliographic entry see Field 5A.
W79-05740

AN UNUSUAL OCCURRENCE OF HEMIAULUS MEMBRANACEUS CLEVE (BACILLARIOPHYCEAE) WITH RICHELIA INTRACELLULARIS SCHMIDT (CYANOPHYCEAE) OFF THE COAST OF SOUTHERN CALIFORNIA IN OCTOBER 1976,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
B. Kimor, F. M. H. Reid, and J. B. Jordan.
Phycologia, Vol 17, No 2, p 162-166, June 1978. 3 fig, 11 ref.

Descriptors: *Hemiaulus membranaceus, *Richelia intracellularis, *Endophytes, *Water temperature, *Phytoplankton, *Marine algae, California, Coasts, Pacific Ocean, Oceans, Algae, Cyanophyta, Diatoms, Chrysophyta, Heterocysts, Trichomes, Filamentous algae, Nitrogen fixation, Nitrogen cycle, Flumes.

An unusual occurrence of cells of the centric diatom Hemiaulus membraneceus containing trichomes of the filamentous blue-green algal Richelia intracellularis, observed 18 October 1976 in the flume of the S10 pier at La Jolla, California, may be due to higher-than-average water temperature (18.5C). There was no clear evidence that nitrogen fixation by Richelia contributed to phytoplankton production. Sixty-two percent of the H. membranaceous cells contained trichomes of R. intracellularis with distinct terminal heterocysts and normal vegetative cells. By 20 October cell numbers were declining, the trichomes of R. intracellularis being in a state of disintegration with only the translucent terminal heterocysts showing in some cells. Persistence of the senescent heterocyst in the host cell is consistent with other records in which it is shown to outlive the rest of the trichome due to a chemical composition different from that of the vegetative cells; it is considered to be the possible site of molecular nitrogen fixation. Association of H. membranaceus and R. intracellularis was intermittently observed November 1976-January 1977. Neither the unusual endophytic association nor the occurrence of large numbers of H. membranaceus had been previously recorded in the area. The apparently short duration of the Hemiaulus occurrence may have been due to transport of the species into the area by warm currents followed by its dying out because of unfavorable nutrient conditions. (Lynch-Wisconsin)
W79-05741

ISOLATION, PURIFICATION AND EVIDENCE FOR A HALOPHILIC NATURE OF THE BLUE-GREEN ALGA APHANOTHECE HALOPHYTICA FREMY (CHROOCOCCALES),
Southern Illinois Univ. at Carbondale. Dept. of Botany.
J. H. Yopp, D. R. Tindall, D. M. Miller, and W. E. Schmid.
Phycologia, Vol 17, No 2, p 172-178, 1978. 9 fig, 33 ref. NASA NGR-14-008-026.

Descriptors: *Aphanothece halophytica, *Halophilic organisms, *Cyanophyta, *Salinity, *Halotolerance, Chroococcales, Purification, Isolation, Prokaryotes, Testing procedures, Methodology, Analytical techniques, Osmosis, Sodium chloride, Salts, Evaporation ponds, Algae.

An axenic culture of an extremely halotolerant (and perhaps halophilic) cyanophyte alga, Aphanothece halophytica (Chroococcales) was obtained by means of a multistep purification procedure. If halophilic, it would be the first known axenic culture of a photoautotrophic prokaryote (blue-green alga) that satisfies all criteria for extreme tolerance of saturated brine: (1) optimal growth in high concentrations of sodium chloride, (2) obligate requirement for relatively high levels of this specific salt for survival, (3) lysis in media of less than 5% NaCl, (4) possession of very high intracellular ionic osmotica, and (5) a requirement for high ionic strength for maintenance of conformation of intracellular proteins. To date such extreme obligate halophilism has only been verified in the bacterial prokaryotes in the families Pseudomonadaceae and Micrococcaceae. The recently reported successful growth of the cyanophyte Coccochloris elabens in media containing 20% NaCl and failure to grow in media of less than 5% NaCl suggests halophilism, but purification was unsuccessful. Lysis of the alga reported here in distilled water and in media of less than one M NaCl, and failure of KCl, LiCl, and CsCl to substitute for NaCl suggest the alga is halophilic rather than only halotolerant. Specimens were isolated from a sample of soft sulfide mud from the bottom of the final solar evaporation pond of a salt production company in Redwood City, California in October 1969. (Lynch-Wisconsin)
W79-05742

ISOLATION, CHARACTERIZATION AND PATHOLOGY OF THE TOXIN FROM A MICROCYSTIS AERUGINOSA (=ANACYSTIS CYNEA) BLOOM,
Commonwealth Scientific and Industrial Research Organization, Parkville Australia). Div. of Protein Chemistry.
T. C. Elleman, I. R. Falconer, A. R. B. Jackson, and M. T. Runnegar.
Australian Journal of Biological Sciences, Vol 31, No 3, p 209-218, 1978. 2 tab, 32 ref.

Descriptors: *Microcystis aeruginosa, *Toxins, *Toxicity, *Lethal limit, *Cyanophyta, *Pathology, Algae, Lakes, Reservoirs, Anacystis cyanea, Eutrophication, Amino acids, Chemical analysis, Laboratory tests, Mice, Australia, Malpas Dam Reservoir(Australia), Liver, Chronicity effects, Sublethal effects, Purification, Isolation.

A toxin isolated from a bloom of the blue-green alga Microcystis aeruginosa (=Anacystis cyanea) in October 1973 at Malpas Dam Reservoir, New South Wales, Australia, has the simplest amino acid composition and highest toxicity of any toxin isolated from M. aeruginosa. The pure toxin is about 20 times stronger than hydrogen cyanide or strychnine on a weight basis. Lyophilized crude algal bloom extracts injected intraperitoneally into laboratory mice were lethal (LD100) 15-30 mg/kg and the LD100 at 0.070 mg/kg based on the total material found from amino acid analysis. The liver was the only organ strongly affected; especially noticeable were the extensive liver hemorrhages preceding recognizable hepatocyte degeneration and necrosis (which was never massive). Hemorrhages and death occurred 1-3 hrs after parenteral administration of the purified toxin. Repeated sublethal doses were lethal only after a period of weeks. Purification involved ammonium sulfate fractionation, solvent extraction, acid precipitation, Sephadex G25 and DEAE-Dephadex chromatography, and high-voltage electrophoresis at pH 9.0, had no free amino group, and was character-

ized by a simple amino acid composition of equimolar quantities of L-methionine, L-tyrosin, D-alanine, D-glutamic acid, erythro beta-methyl aspartic acid, and methylamine. (Lynch-Wisconsin)
W79-05743

BIOLOGICAL EFFECTS OF RICE-FIELD HERBICIDE MACHETE ON VARIOUS STRAINS OF THE NITROGE-FIXING BLUE-GREEN ALGA NOSTOC MUSCORUM,
Banaras Hindu Univ., Varanasi (India). Dept. of Botany.
H. N. Singh, and A. Vaishampayan.
Environmental and Experimental Botany, Vol 18, No 2, p 87-91, May 1978. 4 fig, 3 tab, 33 ref.

Descriptors: *Nostoc muscorum, *Mutation, *Herbicides, *Cyanophyta, *Rice, *Machete, *Toxicity, *Aquatic weed control, Nitrogen fixation, Plant growth, Growth stages, Growth rates, Water pollution effects, Heterocysts, Agriculture, Crop production, Algae, Bioassay, Nitrogen, Fertilization, Fertilizers, Lethal limit, DCMU, Glucose.

The amide preemergent rice-field herbicide under the trade-name 'Machete' (2-chloro-2,6-diethyl-N-(butoxymethyl acetanilide), was toxic and mutagenic to the blue-green alga Nostoc muscorum at 10 micrograms/ml, a dose about one-third of the 27.5 micrograms/ml used in the rice fields (2.5 kg/ha). The higher dose probably causes more damage to the cyanophytes than found in these tests. Nitrogen-fixing blue-green algae are important contributors to rice-field fertility; and fertilization with blue-green algae produces better yields than synthetic nitrogen fertilizers. Machete was toxic and lytic to the parental strain and to two non-nitrogen-fixing mutant strains, designated het(+) nif 11(-) and Em-R het(-) nif 2(-). Intensity of biological effects increased with the growth-promoting efficiency of various inorganic nitrogen sources. The herbicide had no effect on heterocyst differentiation, and induced biological changes were not reversed by glucose. Growth of the three strains was completely inhibited in cultures treated with more than 20 micrograms/ml Machete. At 10 micrograms/ml the parent strain grew slower than controls, and instead of entering the stationary growth phase, lysed at the end of the growth period. Machete appears to be a strong mutagen, as 5-6% of the two mutant strains are prototrophic revertants. The biochemical or molecular mechanism of action of Machete (Monsanto Chemical Company) is largely unknown. (Lynch-Wisconsin)
W79-05744

SALINITY DEPENDENT DISTRIBUTION OF BENTHIC ALGAE IN ESTUARINE AREAS OF ICELANDIC FJORDS,
Slovenska Akademija Znanosti in Umetnosti, Ljublijana (Yugoslavia). Biological Inst.
I. M. Munda.
Botanica Marina, Vol 21, No 7, p 451-468, October 1978. 4 fig, 4 tab, 15 ref.

Descriptors: *Benthic flora, *Algae, *Salinity, *Iceland, *Fjords, *Estuaries, *Distribution, *Intertidal areas, *Estuarine environments, Brackish water, Ecology, Subtidal areas, Zonation, Habitats, Floral lists, Data collections, Borgarfjordur(Iceland), Dyrafjordur(Iceland), Steingrimsfjordur(Iceland), Reydarfjordur(Iceland), Mjoifjordur(Iceland), Berufjordur(Iceland), Pylaiella littoralis, Dictyosiphon chordaria, Porphyra purpurea, Enteromorpha, Cladophora, Biological communities.

Salinity ranges are given in tabular form of benthic algae in the estuarine inner areas of six Icelandic fjords. Salinity, along with substrate configuration, is regarded as the major determinant of the distribution of these algae in the fjords. The fjords, whose inner estuarine areas represent salinity gradients from limnic to marine, were: (1) Borgarfjordur in the southwest, (2) Dyrafjordur in the northwest, (3) Steingrimsfjordur in the north, (4) Reydarfjordur in the mideast, (5) Mjoifjordur in the mideast, and (6) Berufjordur in the southeast. Each fjord is individually described. Distribution of intertidal and subtidal benthic algae was investigated with regard to individual species, algal associations, and zonal patterns. The salinity barrier between brackish and limnic habitats was pronounced in all fjords. Pioneer species included Pylaiella littoralis, Dictyosiphon chordaria, Porphyra purpurea, and representatives of the genera Enteromorpha and Cladophora. In most fjords the first benthic vegetation was composed of an association of dwarf Pyaiella littoralis. In the mixo-oligohaline zone D. chordaria was the main pioneering species, characterized by a salinity-induced reduction in body size. Chlorophytes predominated in the oligohalinikum and in most of the mesohaline area. Some typical marine species were able to penetrate into the estuarine areas. Vegetation in the oligohalinikum was not yet zoned. Enteromorpha intestinalis was the pioneer belt-former. (Lynch-Wisconsin)
W79-05745

COMMUNITY STRUCTURE, DYNAMICS AND NUTRIENTS CYCLING IN THE OKEFENOKEE CYPRESS SWAMP-FOREST,
California Univ., Santa Barbara. Dept. of Biological Sciences.
W. H. Schlesinger.
Ecological Monographs, Vol 48, No 1, p 43-65, 1978. 3 fig, 13 tab, 120 ref.

Descriptors: *Okefenokee Swamp(GA), *Swamp forests, *Biological communities, *Cypress trees, *Cycling nutrients, *Biomass, Georgia, Swamps, Forests, Ecology, Ecosystems, Trees, Nutrients, Peat, Taxodium distichum, Primary productivity, Tillandsia, Bogs, Forest fires, Droughts, Acid waters, Litterfall, Leachates, Closed systems, Data collections, Precipitation(Atmospheric), Biochemistry).

The cypress forest of Okefenokee Swamp in southeastern Georgia, is characterized by low nutrient availability and large peat accumulation; trees are mostly pond cypress (Taxodium distichum), probably due to recurrent understory fires which eliminate other species. Mean values of living stem density (1465 stems/ha) and total basal area (52 sq m/ha) are high compared to upland forests. Differences in density appear due to forest fires during periodic droughts. Use of dimension analysis techniques show that cypresses compse 98% of the total above-water forest biomass of 307 metric tons/ha. Most cypress biomass (96%) is in tree boles, with little (0.8%) in foliage. Total above-water net primary productivity is low (692 g/sq m/yr), presumably because of the acid, nutrient-poor conditions. High biomass is the result of the old age (150 yrs) of the stand and high tree density. Cypress net production is largely channeled into bole wood (41%) and current twigs with needles (41%). Nutrient pools in the above-water community are large (666 kg/ha calcium, 111 kg/ha magnesium, 230 jg/ha potassiu, 996 kg/ha nitrogen, and 46 kg/ha phosphorus), but largely contained in cypress boles, these nutrients do not freely circulate. Foliage abscission and foliar leaching by rainfall return 73-91% of annual nutrient uptake. (Lynch-Wisconsin)
W79-05746

ECOLOGICAL STUDIES ON THE INTERTIDAL ALGAE AT OKHA (INDIA),
Saurashtra Univ., Rajkot (India). Dept. of Biosciences.
M. S. Murthy, M. Bhattacharya, and P. Radia.
Botanica Marina, Vol 21, No 6, p 381-386, August 1978. 6 fig, 14 ref.

Descriptors: *Okha(India), *Intertidal areas, *Ecology, *Algae, *Seasonal, *Zonation, *Littoral, Species composition, Species diversity, India, Coasts, Marine algae, Biomass, Sargassum, Chlorophyta, Phaeophyta, Rhodophyta, Epiphytes, Floral lists, Abundance, Nutrients, Distribution, Dissolved oxygen, Nutrients, Temperature, Water temperature, Gulf of Kutch(India), Arabian Sea.

Intertidal algae was sampled monthly during one growing season (June-February) on the rocky littoral of Okha, Gujarat State, India, (Gulf of Kutch, Arabian Sea) for biomass fluctuations, zonation, and environmental influences; of 47 species found, Sargassum (Phaeophyceae) was the only recorded throughout the study period and found in all parts of the intertidal zone, and was the most important contributor to total biomass. Phaeophyceae and Rhodophyceae contributed more to total biomass than Chlorophyceae, and maximum diversity was found among Rhodophyceae. Overall species diversity increased from the onset of winter in November, when biological activity was accelerated. Air and seawater temperature and dissolved oxygen content were the critical factors governing distribution and biomass of the algae, but mineral content of the water was not related to biomass accumulation, presumably due to remineralization of nutrients from dead plants and efficient mixing. Land in the study area was arid, and during the summer months of May and June the intertidal belt was almost barren; algal germlings appeared in July, with increased biological activity in November, but by the end of February most algae began drying out, leaving the belt barren in April. Chlorophyceae and Phaeophyceae were abundant in middle and lower parts of the mid-littoral, extending to the infra-littoral fringe. Rhodophyceae were rare up to the upper mid-littoral, but abundant in the infra-littoral fringe and zone. (Lynch-Wisconsin)
W79-05747

FOURTH NATIONAL WORKSHOP ON ENTRAINMENT AND IMPINGEMENT,
Proceedings of a Workshop, December 5, 1977, Chicago, Illinois. Jensen, L.D.(Ed.) Ecological Analysts Communications, Melville, New York. 1978 423 p.

Descriptors: *Conferences, *Entrainment, Environmental effects, Regulation, *Impingement.

This publication of the proceedings of the workshop on Entrainment and Impingement contains a compilation of regulatory and technological information. The publication contains 36 papers which are concerned with regulatory issues, entrainment abundance and survival, impingement studies, impact assessment techniques, and engineering aspects of entrainment and impingement. A report of panel discussions in these areas of interest is also included. (See W79-05755 thru W79-05790) (Chilton-ORNL)
W79-05754

IMPLEMENTATION OF SECTION 316 OF THE FEDERAL WATER POLLUTION CONTROL ACT,
Environmental Protection Agency, Washington, DC. Permit Program Div.
S. L. Bugbee.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois p 3-5, 1978.

Descriptors: *Environmental effects, *Regulation, Thermal pollution, Water pollution, Electric power industry, Environmental Protection Agency.

The Federal Water Pollution Control Act of 1972 states an intention 'to restore and maintain the chemical, physical, and biological integrity of the Nation's water.' With the characterization of heat as a pollutant, the steam electric industry was brought under coverage of this act. Section 316(a) of the act governs thermal discharges and Section 316(b) governs cooling water intakes. The paper discusses these two provisions in the light of their relationships and provides an overview of U.S. EPA regulatory programs covering the steam electric industry. (See also W79-05754) (Chilton-ORNL)
W79-05755

THE POWER PLANT REGULATORY PROGRAM: A CONGRESSIONAL DILEMMA,
Committee on Public Works and Transportation (U.S. House).
C. A. Krouse.

In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 7-9, 1978.

Descriptors: *Environmental effects, Regulation, Electric power industry, Thermal pollution, Entrainment, Legislation, Aquatic life, Impingement.

Section 316 of Public Law 92-500 is discussed in light of the difficulties inherent in using the legal advisory system to resolve complicated environmental issues. An overview of a report by the Subcommittee on Investigations and Review focuses on the judgemental character of power plant regulation and raises questions concerning interpretation of language used in Section 316. The conflict over legality and common sense is discussed. (See also W79-05754) (Chilton-ORNL)
W79-05756

REGULATORY DEVELOPMENTS IN SECTION 316(B),
Environmental Protection Agency, Chicago, IL. Enforcement Div.
G. S. Milburn, and G. C. Ginsberg.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 11-20, 1978.

Descriptors: *Environmental effects, *Regulation, *Electric power industry, Thermal pollution, Entrainment, Legislation, Aquatic life, Intakes.

An overview of recent legal and technical developments and their impact on application of Section 316(b) is provided. Implications of decisions in the Seabrook, Brunswick, Wabash River and Cayuga proceedings are discussed as well as the potential application of the ruling in the U.S. Steel v. Train case. Section 316(b) determinations and the technical basis for each for Quad Cities, Dresden, and Prairie Island nuclear power plants and a proposed addition to a fossil facility, Campbell Unit 3, are discussed. Emphasis is placed upon the need for basin- or lakewide evaluation of intake effects and the need for long-term baseline data to assess impacts of power plants. Positive rulings of Section 316(b) are summarized and future directions are discussed. (See also W79-05754) (Chilton-ORNL)
W79-05757

THE ROLE OF THE SCIENTIST IN THE SECTION 316 PROCESS: A LAWYER'S POINT OF VIEW,
LeBoeuf, Lamb, Leiby and MacRae, New York.
G.S.P. Bergen.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 21-24, 1978 2 ref.

Descriptors: *Environmental effects, *Legislation, Technology, Political aspects, Economics, Water pollution, Entrainment, Electric power industry.

It is suggested that the basic role of the scientist is to use his specialized knowledge to assist in making reasonable choices. Scientists, in addition to developing new technologies, must participate in the regulation of those technologies. A responsibility is placed upon the scientist to make sound practical judgements involving not only scientific decisions, but also economic and political factors. (See also W79-05754) (Chilton-ORNL)
W79-05758

EVALUATION OF ICHTHYOPLANKTON SAMPLING GEAR USED IN POWER PLANT ENTRAINMENT STUDIES,
Virginia Inst. of Marine Science, Gloucester Point.
R. R. Bowles, and J. V. Merriner.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 33-43, 1978 2 fig 2 tab 70 ref.

Descriptors: *Environmental effects, *Entrainment, *Sampling, Aquatic populations, Plankton.

Objectives of this study were to describe types of gear in current use for ichthyoplankton sampling, to determine biotic and abiotic factors affecting sampling accuracy, to assess gear accuracy in obtaining representative samples, and to recommend features to be optimized. A nationwide listing of sampling gear in use has been compiled and indexed by aquatic ecosystem type. Factors associated with sampling accuracy include gear design, efficiency, and deployment. Physical/chemical factors and site-specific characteristics are also of importance. Biotic factors affecting accuracy include avoidance, distribution and habitat utilization by aquatic life. It is recommended that sampling gear selection should be critically reviewed as an important element of the total sampling program design. It was concluded that prediction and detection of entrainment related impact has been obscured by incompatibility of data from different sampling gear. The importance of a continuous historical record of population dynamics is emphasized. (See also W79-05754) (Chilton-ORNL)
W79-05759

ENTRAINMENT OF MISSOURI RIVER FISH LARVAE THROUGH FORT CALHOUN STATION,
NALCO Environmental Sciences, Lincoln, NE.
R. G. King.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 45-56, 1978 5 fig, 4 tab, 17 ref.

Descriptors: *Environmental effects, *Entrainment, Larvae, Fish, Missouri River, Thermal stress, Stress, Mortality, Electric power industry, Powerplants.

These studies documented larval fish species composition, abundance, and distribution in the Missouri River. Potential impact on game fish and important commercial fish was low because larvae of these fish made up a low percentage of the entrained ichthyoplankton. Catostomids were entrained throughout the larval season but over 50% survived condenser passage. Freshwater drum accounted for 75% of the entrained larvae; 96% of the larvae collected in the discharge were dead. Entrainment effects were due to both mechanical and thermal stresses. Mixing characteristics of the submerged discharge, rapid dissipation of heat, short exposure to plume temperatures and the low percentage of water used for cooling reduced the potential impact of plume entrainment. The Station entrained 2.1 to 12.4% of the larvae passing the Station. Estimated losses ranged from 2.6 to 5.3% of the total larval assemblage. (See also W79-05754) (Chilton-ORNL)
W79-05760

MORTALITY OF YOUNG STRIPED BASS ENTRAINED AT TWO POWER PLANTS IN THE SACRAMENTO-SAN JOAQUIN DELTA, CALIFORNIA,
California State Dept. of Fish and Game, Stockton.
D. E. Stevens, and B. J. Finlayson.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 57-69, 1978 4 fig, 6 tab, 9 ref.

Descriptors: *Environmental effects, *Entrainment, Striped bass, Fish, Thermal stress, Mortality, Electric power industry, Powerplants, Cooling water.

Mortality estimates for young striped bass of approximately 8 to 31 mm in length were based on differences between percentages of bass alive at the intakes and discharges. Plots of mortality estimates versus discharge temperatures and delta-Ts suggested that heat did not kill bass until discharge temperatures exceeded 31 C and delta-Ts exceeded 7 C. Mean estimates of mortality owing to entrainment at lower temperatures were 13.8 and 10.8%. Mortality estimates increased linearly to 100% with discharge temperature from about 31 to 38 C and delta-Ts from 7 to 17 C. (See also W79-05754) (Chilton-ORNL)
W79-05761

SURVIVAL OF ENTRAINED ICHTHYOPLANKTON AND MACROINVERTEBRATES AT HUDSON RIVER POWER PLANTS,
Ecological Analysts, Inc., Middletown, NY.
T. C. Cannon, S. M. Jinks, L. R. King, and G. J. Lauer.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 71-89, 1978 6 fig, 15 tab, 13 ref.

Descriptors: *Environmental effects, *Entrainment, Mortality, Hudson River, Fish, Larvae, Invertebrates, Thermal pollution, Thermal stress, Electric power industry, Powerplants.

Entrainment survival studies conducted at six Hudson River powerplants indicated that entrainment mortality is minimal when discharge temperatures are maintained below lethal thermal thresholds. Laboratory data on striped bass, white perch, and Clupeidae larvae indicated threshold thermal tolerance limits at about 32 C with 10 minute TL50s of 33 to 36 C. For ichthyoplankton, high mortalities attributable to thermal stress were observed at the plants at temperatures above 30 C. For most macroinvertebrates, entrainment mortality was not observed except extreme under extreme summer conditions (discharge temperatures of 35 C or higher). (See also W79-05754) (Chilton-ORNL)
W79-05762

SURVIVAL OF PLANKTONIC ORGANISMS FOLLOWING PASSAGE THROUGH A SIMULATED POWER PLANT CONDENSER TUBE,
Tetra Tech, Inc., Lafayette, CA.
T. C. Ginn, G. V. Poje, and J. M. O'Connor.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 91-101, 1978 8 fig, 3 tab, 15 ref.

Descriptors: *Environmental effects, *Entrainment, Thermal pollution, Thermal stress, Electric power industry, Fish, Larvae, Plankton, Cooling water, Temperature, Pressure, Flow, Velocity, Chlorination.

A power plant condenser tube simulator was designed which can test organisms reaction to the velocities, temperature changes, biocide concentrations, and pressure changes which are encountered in a condenser tube during pumped entrainment. Test organisms used in these studies were striped bass larvae (Morone saxatilis), carp (Cyprinus carpio), phantom midge larvae (Chaoborus americanus), and the estuarine amphipod Gammarus tigrinus tests using the simulator showed that at sublethal temperatures there were no detectable lethal effects of passage on the species tested. Interactive effects between individual stresses were observed at or near lethal exposure temperatures. Reduced survival of Chaoborus larvae was seen at a combination of subatmospheric pressure and near-lethal temperature. Supra-additive interactions were observed between chlorine and temperature/condenser stresses for both Gammarus and striped bass larvae. Results of studies indicate that the magnitudes of net collection mortalities are dependent on temperature. (See also W79-05754) (Chilton-ORNL)
W79-05763

MODELS USEFUL FOR THE ESTIMATION OF EQUILIBRIUM POPULATION REDUCTION DUE TO POWER PLANT CROPPING,
Lawler, Matusky and Skelly, Pearl River, NY.
J. P. Lawler, and T. L. Englert.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois, p 103-113, 1978. 15 fig, 15 ref.

Descriptors: *Environmental effects, *Entrainment, *Model studies, Forecasting, Populations, Electric power industry, Powerplants, Cooling water.

The objective of this paper is to present means of estimating the effect of water withdrawal on long-term equilibrium populations. The analysis presented includes approaches for estimating the compen-

satory response of biological populations to entrainment impact. Extensions of the Ricker and Beverton-Holt analyses (including application of Ricker's analysis to a multiple-age spawning population, a dissection of Ricker's alpha into its component parts in a multiple-age spawning population, and modification of Ricker's equation to include the effects of additional system stresses on Ricker's beta) are considered. A general increase in the level of compensatory response in comparison with the level obtained using the classical Ricker model is indicated. The study indicates that the ultimate level of impact caused by operation of once-through cooling may even result in a net population increase. (See also W79-05754) (Chilton-ORNL)
W79-05764

A METHOD FOR DETERMINING GROWTH AND MORTALITY RATES OF ICHTHYOPLANKTON,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development.
P. A. Hackney, and J. C. Webb.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 115-124, 1978 8 fig, 4 tab, 4 ref, 1 append.

Descriptors: *Environmental effects, *Entrainment, *Model studies, Larvae, Mortality, Growth rate, Plankton, Fish.

This work is a study of differential equations that describe the growth-mortality dynamics of larval fish populations. By enumerating by length class of taxonomic groups, average growth rate of ichthyplankton hatched over a spawning season can be determined from samples taken throughout the season. Numbers of a given length class for a species typically form a distribution through time. The mean of these distributions occurs progressively later in the year for increasing length groups and is the date on which the average individual achieved the length in question. A plot of these dates against the corresponding length groups yields a graph from which the growth rate can be determined. Mortality rate can also be determined from these data. The area under the time-frequency distribution curve is the total number of larvae of that length class which occurred during the year. Since time required to grow to succeeding length classes has been determined, a plot of total numbers by size class against the date the average individual achieved that length yields a graph from which mortality rate coefficient can be determined. (See also W79-05754) (Chilton-ORNL)
W79-05765

EFFECTS OF THE DONALD C. COOK NUCLEAR POWER PLANT ON ZOOPLANKTON OF SOUTHEASTERN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
M. S. Evans, B. E. Hawkins, and T. E. Wurster.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 125-139, 1978 12 fig, 3 tab, 13 ref.

Descriptors: *Environmental effects, *Entrainment, Thermal pollution, Zooplankton, Electric power industry, Water pollution, Nuclear powerplants.

An overview of the preoperational and operational zooplankton monitoring program at the plant are provided. Data from the monitoring program show that a maximum of 12% of entrained zooplankton were killed by condenser passage and that there was no evidence of delayed mortality within 24 hours after passage. It was concluded that the once-through cooling system in use at this plant seems to be effective in minizing the effects of thermal pollution in the receiving water. This is accomplished primarily by operating at discharge temperatures only 10 C above ambient lake temperatures and by rapidly mixing condenser-passed water into the lake through the use of a jet rather than a canal. The location of the plant on a large body of water is also an important factor in reducing the environmental effects of discharging large volumes of heated water. (See also W79-05754) (Chilton-ORNL)
W79-05766

ENTRAINMENT OF CRUSTACEAN ZOOPLANKTON THROUGH FORT CALHOUN STATION,
NALCO Environmental Sciences, Lincoln, NE.
G. D. Rogers.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 141-154, 1978 5 fig, 6 tab, 20 ref.

Descriptors: *Environmental effects, *Entrainment, Thermal stress, Water pollution, Thermal pollution, Electric power industry, Cooling water, Zooplankton, Mortality, Nuclear powerplants.

This report documents the results of a monitoring program conducted from October 1973 through June 1977. Copepoda generally accounted for >75% of the total zooplankton. Entrainment losses averaged 3.7% immediately after passage (0 hours), 2.8% at 4 hours, and 3.8% at 24 hours. Thermal stress was apparently the principal factor in reducing zooplankton motility at 0 hours. Mechanical stress accounted for an average increase in immotility of 1.1%. Entrainment losses were high when absolute discharge temperatures were > or = 35C. Viability was generally not dependent on delta-T. Losses for the total river zooplankton community resulting from Station operation did not exceed 0.6% on any sampling date. (See also W79-05754) (Chilton-ORNL)
W79-05767

MACROINVERTEBRATE ENTRAINMENT STUDY AT FORT CALHOUN STATION,
NALCO Environmental Sciences, Lincoln, NE.
S. R. Carter.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 155-169, 1978 5 fig, 6 tab, 34 ref.

Descriptors: *Environmental effects, *Entrainment, Thermal stress, Invertebrates, Missouri River, Mortality, Electric power industry, Cooling water, Water pollution, Thermal pollution.

Samples of drifting macroinvertebrates were collected twice monthly from October 1973 to June 1977. Samples were comprised of Hydropsychidae (37%), Chironomidae (24%), Heptagenidae (8%), and Caenidae (6%). Differential mortality for the entrained drift assemblage ranged from 0.0 to 18.2% and average 7.7% during the study. Differential mortalities on operational sampling dates averaged 8.6%; losses during shutdown periods averaged 3.4%. Entrainment losses resulted primarily from thermal stress with losses averaging as high as 10% during periods of high absolute discharge temperatures (32 to 37 C). It was concluded that, assuming uniform drift distribution in the river, mortality for the total assemblage increased an average of 0.2% as a result of entrainment. (See also W79-05754) (Chilton-ORNL)
W79-05768

EFFECTS OF ACUTE THERMAL STRESS ON MARINE FISH EMBRYOS AND LARVAE,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
W. F. Hettler, and L. C. Clements.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 171-190, 1978 8 fig, 10 tab, 6 ref.

Descriptors: *Environmental effects, *Entrainment, Thermal stress, Water pollution, Marine fish, Larvae, Embryonic growth stage, Electric power industry, Cooling water.

Investigations were conducted to determine survival of embryos and larvae of spot (Leiostomus xanthurus) and black sea bass (Centropristis striata). Developmental stages tested were pregastrula, early- and mid-embryo, and five larval ages up to 30 days old. Acclimation temperatures were 16, 20, and 24 C. Delta-Ts of 8-14 C were chosen for 16 C acclimation, 6-12 C for 20 C, and 4-10 C for 24 C. Pregastrula spot were found to be more susceptible to thermal stress than later embryonic stages. Spot larvae showed no relationship between age and survival following exposures of up to 12 C above ambient temperatures. Black sea bass showed similar mortalities at both early and late embryonic stages. Embryos slowly returned to ambient temperatures after exposure to thermal stress showed increased survival over those rapidly cooled. (See also W79-05754) (Chilton-ORNL)
W79-05769

IMPACTS OF THREE TYPES OF POWER GENERATING DISCHARGE SYSTEMS ON ENTRAINED PLANKTON,
Beak Consultants Ltd., Mississauga (Ontario).
R. W. Crippen, F. K. Fahmy, B. Seepersad, and A. M. Hayton.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 191-202, 1978 5 fig, 5 tab, 19 ref.

Descriptors: *Environmental effects, *Entrainment, Plankton, Phytoplankton, Fish, Larvae, Thermal stress, Water pollution, Discharge(Water), Design, Cooling water, Electric power industry, Zooplankton.

Using field observations and laboratory entrainment simulations, the responses of phytoplankton, zooplankton, and ichthyoplankton to onshore, offshore, and tempering discharge systems were evaluated. A wide range of delta-Ts for each discharge system were simulated. A critical temperature range (ambient temperature + delta-T) was found to cause a reduction in primary production in phytoplankton and increased mortality in zooplankton but no significant differences were found among the three systems tested. A seasonal shift in tolerance to the critical temperature was noted for both phytoplankton and zooplankton. Results of tests of fish larvae of five species exposed to simulated thermal regimes indicated a significant difference among the discharge systems at effective delta-Ts with the tempering system being the least harmful. (See also W79-05754) (Chilton-ORNL)
W79-05770

MORTALITIES OF THE LARVAE OF TWO SPECIES OF BIVALVES AFTER ACUTE EXPOSURE TO ELEVATED TEMPERATURE,
Maine Univ., Walpole. Ira C. Darling Center for Research Teaching and Service.
S. L. Barker, and J. R. Stewart.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 203-210, 1978 4 fig, 5 tab, 22 ref.

Descriptors: *Environmental effects, *Entrainment, *Thermal stress, Larvae, Molluscs, Mortality, Cooling water, Electric power industry, Temperature.

The effect of short-term exposures to elevated temperature on the larvae of Mytilus edulis and Mya arenarea are described. The larvae were subjected to differing levels of temperature increase for exposure times of from 5 to 180 minutes in a thermal gradient apparatus. Organisms were held for 24 hours after exposure to allow for delayed mortality. Thermal tolerances of the larvae increased from cleavage to straight-hinge stage. It was suggested that the water temperature at the time of spawning may be important in determining whether bivalve larvae survive the thermal shock of passing through a condenser cooling water system. The combination of ultimate exposure temperature and the period of exposure are both important factors in larvae survival. (See also W79-05754) (Chilton-ORNL)
W79-05771

IMPINGEMENT SURVIVAL STUDIES ON WHITE PERCH, STRIPED BASS, AND ATLANTIC TOMCOD AT THREE HUDSON RIVER POWER PLANTS,
Ecological Analysts, Inc., Middletown, NY.
L. R. King, J. B. Hutchison Jr, and T. G. Huggins.

In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 217-233, 1978 14 fig, 11 tab, 12 ref.

Descriptors: *Environmental effects, *Screens, Intakes, Mortality, Powerplants, Electric power industry, Fish, Intakes structures, *Impingement.

Impinged fish were collected from the screenwash discharge at Bowline Point, Roseton, and Danskammer Point Generating Stations. Three modes of traveling screen operation were tested: continuous wash, 2-hour hold, and 4-hour hold. The studies showed that there generally is an increase in survival associated with decreased time between screenwashes. Highest probalities of initial and latent survival of young of the year white perch and striped bass w ere generally observed for the continuous screenwash mode. Survival probability of Atlantic tomcod was high at Roseton and Danskammer Point plants regardless of screenwash pressure or mode. It was concluded that reducing the impingement stress at the intake structure by either modifying the traveling screens or their mode of operation could reduce or eliminate mortalities for all three species. (See also W79-05754) (Chilton-ORNL)
W79-05772

SURVIVAL OF FISHES AND MACROINVERTEBRATES IMPINGED AT OYSTER CREEK GENERATING STATION,
Ichthyological Associates, Inc., Forked River, NJ.
T. R. Tatham, D. L. Thomas, and G. J. Miller.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 235-243, 1978 5 fig, 3 tab, 10 ref.

Descriptors: *Environmental effects, *Screens, Intakes, Intakes structures, Mortality, Fish, Invertebrates, Electric power industry, Powerplants, *Impingement.

The rate of survival and mortality for impinged fishes and macroinvertebrates was found to vary widely by species. Overall, organisms that have been traditionally regarded as hardy had relatively good survival while fishes that are traditionally difficult to collect and handle in good condition had poor survival. Organisms having a hard exoskeleton, bony plates or a defensive mechanism had high immediate survival. Some seasonal variation was observed. Preliminary data suggested that continuous operation of the traveling screens increased survival and decreased mortality. (See also W79-05754) (Chilton-ORNL)
W79-05773

AN ANALYSIS OF FACTORS INFLUENCING THE IMPINGEMENT OF THREADFIN SHAD AT POWER PLANTS IN THE SOUTHEASTERN UNITED STATES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
J. M. Loar, J. S. Griffith, and K. D. Kumar.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 245-255, 1978 2 fig, 5 tab, 8 ref.

Descriptors: *Environmental effects, *Screens, Intakes, Intakes structures, Electric power industry, Fish, Powerplants, Mortality, *Impingement, Shad.

Data on intake design and location, plant operating procedures, water quality, numbers of fish impinged, and sampling procedures were analyzed for 27 fossil-fueled and 5 nuclear power plants. Young of the year and yearling threadfin shad accounted for the majority of fish impinged. Important parameters influencing shad impingement were water temperature and the distribution and abundance of shad in the cooling water source. Maximum impingement rates occurred in winter when intake temperatures dropped below 10C. (See also W79-05754) (Chilton-ORNL)
W79-05774

COMPARATIVE FISH IMPINGEMENT AT TWO ADJACENT WATER INTAKES ON THE MID-COLUMBIA RIVER,
Battelle Pacific Northwest Labs., Richland, WA. Ecosystems Dept.
T. L. Page, D. A. Neitzel, and R. H. Gray.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 257-266, 1978 8 fig, 4 tab, 5 ref.

Descriptors: *Environmental effects, *Screens, Fish, Fish behavior, Mortality, Columbia River, Electric power industry, Intakes, Intakes structures, *Impingement.

This paper compares fish impingement at two adjacent water intakes located about 276 m apart at River Mile 380 on the Columbia River. Collections from traveling screens at Station A yielded a total of 89 chinook fry while 766 chinook fry were collected from Station B during the same period. Impingement of 10 other species was similar at both intakes except that Station B impinged twice as many yellow perch as did Station A. It was suggested that subtle differences in forebay configuration, curtain wall location, and possible differences in fish behavioral responses to the two facilities may be responsible for the differences in impingement between the two facilities. (See also W79-05754) (Chilton-ORNL)
W79-05775

STATISTICAL COMPARISON AND CHOICES OF SAMPLING DESIGNS FOR ESTIMATING FISH IMPINGEMENT AT COOLING WATER INTAKES,
Argonne National Lab., IL.
I. P. Murarka, S. A. Spigarelli, and D. J. Bodeau.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 267-279, 1978 10 fig, 5 tab, 10 ref.

Descriptors: *Environmental effects, *Screens, Sampling, Mortality, Model studies, Fishkill, Intakes, Intakes structures, Powerplants, Forecasting, *Impingement.

The efficiencies and statistical properties for estimating fish kills of six sampling designs are compared and recommendations are made. The stratified systematic random and the stratified random sampling scheme appear to be the most appropriate for use in estimating fish impingement at cooling water intakes. It is recommended that sampling intensity should be between 75 and 180 days per year. Regardless of the sampling design used, the maximum sampling should be conducted during the time periods when variability in day-to-day fish kills is very large. (See also W79-05754) (Chilton-ORNL)
W79-05776

TEMPORALLY STRATIFIED SAMPLING PROGRAMS FOR ESTIMATION OF FISH IMPINGEMENT,
Oak Ridge National Lab., TN. Environmental Sciences Div.
K. D. Kumar, and J. S. Griffith.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 281-289, 1978 2 fig, 8 tab, 9 ref.

Descriptors: *Environmental effects, *Screens, * *Monitoring, Sampling, Seasonal, Temporal distribution, Freshwater fish, Electric power industry, Powerplants, Cooling water, Intakes, Intakes structures, *Impingement.

This paper is concerned with the estimation of the annual rate of impingement when impingement counts exhibit temporal patterns. Monitoring programs were designed to meet two situations: (1) when prior data on impingement were available and (2) when no impingement data were available but counts were known to be correlated with some other parameter such as water temperature. Data gathered from 32 generating stations throughout the southeastern United States showed that a temporally stratified sampling program can be used to obtain reliable estimates of annual impingement rates. Of the possible temporal patterns within a calendar year, it was found that differences between seasons were most influential in impingement of freshwater fishes. (See also W79-05754) (Chilton-ORNL)
W79-05777

A CONCEPTUAL MODEL OF CAUSAL FACTORS REGARDING GIZZARD SHAD RUNS AT STEAM ELECTRIC POWER PLANTS,
Detroit Edison Co., MI. Engineering Research Dept.
P. J. Eisele, and J. F. Malaric.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 291-298, 1978 6 fig, 2 tab, 5 ref.

Descriptors: *Environmental effects, *Screens, *Model studies, Monitoring, Fish, Streams, Intakes, Intakes structures, Electric power industry, Powerplants, *Impingement, Shad, Fish runs.

During three years of continuous fish collection using a fish pump at the Monroe Power Plant, various environmental parameters (power plant operating conditions, water quality, and weather conditions) were measured. These parameters were used in regression analysis to determine their effect on shad runs. Data indicated that only water transparency contributed significantly to variations in shad density. Most runs occurred during warm - water recirculation. Causal relationships are identified through the use of a conceptual model. (See also W79-05754) (Chilton-ORNL)
W79-05778

EFFECT OF ENVIRONMENTAL VARIABLES ON FISH IMPINGEMENT,
State Univ. of New York at Buffalo. Dept. of Biology.
W. S. Lifton, and J. F. Storr.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 299-311, 1978 15 fig, 27 ref.

Descriptors: *Environmental effects, *Intakes structures, Fish, Screens, Electric power industry, Powerplants, Seasonal, Temperature, Winds, Waves(Water), Precipitation(Atmospheric), Cloud cover, *Impingement.

These studies were conducted at C. R. Huntley Power Station which employs a shoreline intake system and at R.E. Ginna Power Station which uses an offshore intake. Results of the study indicated that there are a number of reasons for variation in impingement besides normal seasonal migrations. Important factors were wave height, water temperature, wind direction, sky cover and precipitation, and wind speed. These factors affected impingment of fish at both offshore and onshore intakes. It was also found that fish may use the lee side of an offshore intake as shelter during high winds. (See also W79-05754) (Chilton-ORNL)
W79-05779

POSSIBILITIES FOR ASSESSMENT OF THE EFFECTS OF POWER PLANT OPERATION AT THE ECOSYSTEM LEVEL,
Lawler, Matusky & Skelly, Pearl River, NY.
E. K. Pikitch, R. A. Alevras, J. M. Hillegas, Jr., and D. T. Logan.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL. p 315-320, 1978. 7 ref.

Descriptors: *Environmental effects, *Assessments, Powerplants, Electric power industry, Ecosystems.

This paper describes progress on a project to develop guidelines and procedures applicable to ecosystem-level impact analysis. It is suggested that a bilevel approach, which evaluates ecosystems from the different points of view of macroscopic parameters and species interactions, is the best approach. Several macroscopic parameters and analytical approaches which are discussed are persistence, resiliency, diversity, community analysis, loop analysis,

and the mean length and size frequency distribution of planktonic organisms. The use of microcosm experiments and computer simulation models was suggested for implementation of the species interaction approach. (See also W79-05754) (Chilton-ORNL)
W79-05780

A MATHEMATICAL MODEL OF THE INTERACTIONS OF AN AQUATIC ECOSYSTEM AND A THERMAL POWER STATION COOLING SYSTEM,
Tetra Tech, Inc., Lafayette, CA.
K. F. Haven, and T. C. Ginn.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL. p 321-341, 1978. 10 fig, 14 tab, 68 ref.

Descriptors: *Model studies, *Environmental effects, *Assessments, *Powerplants, Electric power industry, Ecosystems, Aquatic environments.

Methodology for the model described provides stepwise guidance, decision making criteria, analytical models, and an analysis of available data collection methods. It is designed to be used as a long-range planning tool for the design and location of proposed power plants so that either total power output can be maximized subject to aquatic constraints or aquatic ecosystem impacts can be minimized subject to power production constraints. Five basic analytical elements supporting the methodology are presented: a series of hydrodynamics models, a water quality and ecosystem model, population dynamics models, a planning and system optimization model, and the power plant assessment model. The ecosystem model acts as the central integration and assessment tool. The power plant assessment model acts as the primary driving force for the ecosystem level assessment by providing a detailed assessment of the interaction of each segment of a power plant and the local aquatic environment. (See also W79-05754) (Chilton-ORNL)
W79-05781

AN APPROACH FOR THE ANALYSIS OF STRIPED BASS ENTRAINMENT SURVIVAL AT HUDSON RIVER POWER PLANTS,
Ecological Analysts, Inc., Middletown, NY.
S. M. Jinks, T. Cannon, D. Latimer, L. Claflin, and G. Lauer.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL., p 343-350, 1978.

Descriptors: *Environmental effects, *Entrainment, Striped bass, Mortality, Electric power industry, Powerplants, Hudson River, Model studies, Thermal stress.

Studies have shown that a high percentage of striped bass are capable of surviving the entrainment experience when the temperature of the circulating water system is below lethal limits, and that mortality increases concurrently with elevation in discharge temperature above these limits. Thermal exposure factors considered in this study were ambient water temperature, delta-T of circulating water, and transit time. These factors were dependent on season, plant generating load, and circulating water flow rate. Mechanical effects on entrainment survival were determined from field entrainment studies. Thermal effects were described by regression models based on thermal laboratory results and on incorporating dependence on acclimation temperature and exposure duration. (See also W79-05754) (Chilton-ORNL)
W79-05782

PERSPECTIVES ON FISH IMPINGEMENT,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
R. K. Sharma.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL. p 351-356, 1978.

Descriptors: *Environmental effects, *Intakes structures, Screens, Fish, Monitoring, Sites, Design, Electric power industry, Powerplants, *Impingement.

This paper examines the objectives of fish impingement studies, monitoring programs, variables affecting fish impingement, siting and design criteria, the state of the art of screening systems, and suggestions for meeting 316(b) requirements. It is suggested that future emphasis in fish impingement related matters should include study of siting and design criteria; a ranking of intake screening systems for biological effectiveness and engineering feasibility; monitoring programs which would consider fish kill as related to population level impacts; redirection of funds and resource to technology development; and a revision of 316(b) guidelines. (See also W79-05754) (Chilton-ORNL)
W79-05783

DOCUMENTATION OF DATA AND LITERATURE RELEVANT TO THE ASSESSMENT OF THERMAL POWER PLANT COOLING SYSTEM EFFECTS ON AQUATIC ENVIRONMENTS,
Atomic Industrial Forum, Inc., Washington, DC.
E. H. Hannon, and R.F. Carrier.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL. p 357-359, 1978.

Descriptors: *Data collections, *Data storage and retrieval, Bibliographies, *Environmental effects, Aquatic life, Powerplants, Thermal powerplants, Cooling water, Entrainment, Chemical wastes, Impingement.

The bibliographic computer data base reported here covers the subject areas of thermal effects, chemical effects, impingement, and entrainment. Both open and gray literature are included in the data base which became available for search and retrieval by industry in 1978. (See also W79-05754) (Chilton-ORNL)
W79-05784

ENGINEERING IMPLICATIONS OF NEW FISH SCREENING CONCEPTS,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 8I.
W79-05785

PRELIMINARY STUDIES ON THE OPERATING ASPECTS OF SMALL SLOT WIDTH WEDGEWIRE SCREENS WITH CONCEPTUAL DESIGNS FOR POWER STATION USE,
United Engineers and Constructors, Inc., Philadelphia, PA.
For primary bibliographic entry see Field 8I.
W79-05787

A PRACTICAL INTAKE SCREEN WHICH SUBSTANTIALLY REDUCES THE ENTRAINMENT AND IMPINGEMENT OF EARLY LIFE STAGES OF FISH,
Ichthyological Associates, Inc., Middletown, DE.
For primary bibliographic entry see Field 8I.
W79-05788

CHEMISTRY OF PHOSPHORUS, CADMIUM, COPPER, NICKEL, LEAD, AND ZINC IN INDIANA LAKE AND RESERVOIR SEDIMENTS,
Purdue University Water Resources Research Center, West Lafayette, Indiana.
For primary bibliographic entry see Field 5B.
W79-05794

A REVIEW OF PHYTOPLANKTON STUDIES IN LAKE LIVINGSTON, TEXAS,
Trinity River Authority, Arlington, TX. Planning and Environmental Management Div.
K. C. Rudy.
The Texas Journal of Science, Vol. 30, No. 3, p 273-282, September 1978. 3 fig, 2 tab, 19 ref.

Descriptors: *Lake Livingston(TX), *Reservoirs, *Phytoplankton, *Eutrophication, *Limiting factors, *Primary productivity, *Reviews, Chlorophyll, Lakes, Trinity River(TX), Texas, Rivers, Carbon radioisotopes, Bioassay, Nitrogen, Phosphorus, Nutrients, Water pollution sources, Water pollution effects, Abundance, Seasonal, Data collections.

Phytoplankton-related studies conducted in Lake Livingston, a eutrophic reservoir on the Trinity River, Texas fall into two general categories: (1) primary productivity measurements, and (2) limiting nutrient studies. The first group used chlorophyll-a, cell enumerations, and carbon-14 to measure phytoplankton abundance and productivity. The limiting nutrient experiments were all variations of the nutrient spike, emphasizing nitrogen and phosphorus. Lake Livingston has exhibited numerous eutrophic symptoms since impoundment was completed in November 1971, due mainly to high nutrient input from the Trinity River. Symptoms include anoxic summer hypolimnia, large di urnal DO variations, and proliferation of phytoplankton and macrophytes. In a 1975 study (McCullough 1976) mean productivity was determined at 70.9 mg C/cu m/hr, ranging from 0.8 mg in May to 358.6 mg in July, both extremes in the upper part of the reservoir. Mean chlorophyll-a concentration was 24.6 micrograms/l, with a maximum of 69.4 micrograms on 30 August. There was a highly significant correlation between chlorophyll-a and primary productivity. A study in 197 (EPA 1977) showed phytoplankton cell counts ranged from one million/l in November to over 1 million in May. A 1969-70 study (Huang, et. a 1973) concluded that nitrogen was limiting in summer in the main part of the reservoir, bu available phosphorus regulated growth of the dominant cyanophytes in late summer. (Lynch Wisconsin)
W79-05806

PHYSIOLOGICAL EFFECTS OF 2,4-D AN 2,4,5-T ON SELECTED AQUATIC ORGANISMS,
Clemson Univ., SC. Dept. of Zoology.
C. F. Sigmon.
Available from the National Technical Informatio Service, Springfield, VA 22161 as PB-294 53 Price codes: A03 in paper copy, A01 in microfich Water Resources Research Institute, Clemson Un versity, Report No 75, April 1979, 22 p. 6 tab, ref. OWRT A-038-SC(1).

Descriptors: Sublethal effects, Bioconcentratio Water pollution effects, Aquatic animals, Herbicides, 2,4-D, 2,4,5-T, Chironomids, Bluegill, Dap nia.

The sublethal effects of 2,4-D and 2,4,5-T (butoxyethanol esters) on several aquatic animals we examined. The herbicide did not significan affect oxygen consumption in Lepomis macrochirus (bluegill) exposed to 3 ppm. Little herbici was retained by fish which were exposed to 3 pp of 2,4-D or 2,4,5-T for eight days. Daphnia pu exhibited greater oxygen consumption when posed to 3 ppm of 2,4,5-T at 30C. Oxygen co sumption in control and treatment groups did differ at lower temperatures or for 2,4-D expo Mortality, pupation, and emergence were exa ined for Chironomus sp. exposed to 1 or 3 ppm 2,4-D or 2,4,5-T. Significantly greater mortal and lower percentage pupation were observed groups exposed to 3 ppm, 2,4,5-T at 30C.
W79-05830

WATER QUALITY: STREAMS AND PON ON SELECTED TEST AREAS ON EGLIN A FORCE BASE, FLORIDA,
Air Force Armament Lab., Eglin, AFB, FL.
R. C. Crews, G. G. Wyman, S. M. Lefstad, and I. Miller.
Available from the National Technical Informat Service, Springfield, VA 22161 as AD-A049 Price codes: A03 in paper copy, A01 in microfi Report AFATL-TR-77-72, May 1977. 32 p, 9 fi ref, 1 append.

Descriptors: *Water quality, *Florida, *Baseline studies, *Chemical oxygen demand, Streams, Ponds, Hardness(Water), Turbidity, Calcium, Phosphates, Nitrates, Temperature, Dissolved oxygen, Hydrogen ion concentration, Monitoring, Eglin Air Force Base(FL).

Baseline information on water quality was derived for streams and ponds draining or located on the Eglin Air Force Base Reservation, Florida. The water temperature displayed seasonal trends (mean seasonal range 15.5C to 22.9C). The dissolved oxygen (DO) values were inversely related to the water temperature. The mean seasonal DO range was 7.6 ppm to 9.0 ppm. The mean seasonal pH was low, range 5.6 to 5.7, displaying no seasonal trends. Also remaining consistently low and displaying no seasonal trends were the calcium, chemical oxygen demand (COD), phosphates, and turbidity. The water was very soft, with a mean seasonal hardness range of 3.3 mg/l to 4.4 mg/l. The water quality at the 10 selected test areas was good. It was typified by an acid pH, hardness of 3.30 mg/l to 5.69 mg/l, a temperature range of 9.5C to 31.0C, a DO range of 3.8 ppm to 11.1 ppm, and relatively low levels of other naturally occurring constituents. (Visocky-ISWS)
W79-05839

THE PRESENCE OF POLLUTANT HYDROCARBONS IN ESTUARINE EPIPELIC DIATOM PPOPULATIONS. II. DIATOM SLIMES,
Bristol Univ. (England). School of Chemistry.
S. Thompson, and G. Eglinton.
Estuarine and Coastal Marine Science, Vol 8, No. 1, p 75-86, January 1979. 3 fig, 2 tab, 34 ref.

Descriptors: *Oil pollution, *Water pollution effects, *Estuaries, *Diatoms, *Sediments, Bottom sediments, Environmental effects, *Outer Continental Shelf, *Hydrocarbons, Severn Estuary(U.K.).

Preliminary studies of estuarine epipelic diatom populations showed a selective incorporation of sediment (crude oil-type) aliphatic hydrocarbons, and an apparent exclusion of polycyclic aromatic hydrocarbons. In the present study the aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAH) of the diatom slime from the surface of an intertidal estuarine sediment have been analysed by improved analytical techniques including computerized capillary gas chromatography/mass spectrometry, and their distributions have been compared with those of the underlying sediment and the sediment-free diatom population. The aliphatic hydrocarbon distribution of the diatom slime appeared to be the sum of those of the separated diatoms and the underlying sediment. The distribution of polycyclic aromatic hydrocarbon in the diatom slime was qualitatively similar to that of the underlying sediment. However, the quantity of polycyclic aromatic hydrocarbon in the diatom slime was around 9 times less than would have been expected for the sum of the diatoms and the underlying sediment. The aliphatic hydrocarbons of the separated diatoms showed a relatively low carbon number distribution. The presence of a major component with the g.c. retention, and mass spectral features of all-cis-heneicosahexa 3,6,9.12,15,18-ene is reported. Only traces of polycyclic aromatic hydrocarbons were detected in the separated diatoms. The results suggest a loss of polycyclic aromatic hydrocarbons from the coalesced sediment in the diatom slime, which may be explained by either a photo-oxidative or catabolic process. (See also W79-02998) (Sinha-OEIS)
W79-05884

SIMULATION MODELING OF MARINE BIRD POPULATION ENERGETICS, FOOD CONSUMPTION, AND SENSITIVITY TO PERTURBATION,
Oregon State Univ., Corvallis.
J. A. Wiens, G. Ford, D. Heinemann, and C. Fieber.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. II, Receptors--Birds, p 1-83, October 1978. 16 fig, 55 tab, 14 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Birds, *Energy, *Alaska, Baseline studies, Resources development, Water pollution effects, Environmental effects, Oil pollution, Hazards, *Outer Continental Shelf, Bering Sea, Pribilof Islands, Petroleum development.

The approach and results of initial applications of computer simulation modeling of avian population energetics to Alaskan OCS marine bird systems are presented. The report considers estimations of energy demands of marine birds as recorded at sea during transect censuses in the Gulf of Alaska/southeast Bering Sea and in the vicinity of the Pribilof Islands; more intensive analyses of breeding colonies will occupy the next phase of the project. Total energy flow through pelagic bird populations in the Gulf of Alaska was greatest in the Kodiak area during August-September, but varied both between areas and with season, primarily as a consequence of movements of species populations associated with reproductive status. Activities related to petroleum development in these areas may be especially hazardous to bird populations. (Sinha-OEIS)
W79-05885

SHOREBIRD DEPENDENCE ON ARCTIC LITTORAL HABITATS,
California Univ., Bodega Bay. Bodega Marine Lab.
P. G. Connors.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol II, Receptors--Birds, p 84-166, October 1978. 16 tab, 18 ref, 7 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-84.

Descriptors: *Birds, *Oil spills, *Water pollution effects, *Habitats, Ecology, Resources development, Alaska, Baseline studies, *Outer Continental Shelf, Shorebirds.

Shorebirds (sandpipers, plovers, and their relatives) are a major and important component of the Alaskan arctic avifauna. Seasonal, and occasionally very heavy, use of littoral (shoreline) habitats by shorebirds and other birds in the Arctic have been documented. The ultimate objective is the assessment of the degree and nature of dependence of shorebird species on arctic habitats which are potentially susceptible to perturbation from offshore oil development activities. Within this objective, critical habitats, critical trophic processes, and critical areas of the Beaufort and Chukchi coasts are identified and the relative susceptibilities of each shorebird species to potential disturbances are estimated. The implications for OCS oil development are clear. Leasing and development should be planned to minimize the threat to the most heavily used and most sensitive areas and habitats, and to avoid disturbances during periods of highest potential impact on bird populations. The effect of any oil spill could be quite serious depending upon timing as well as magnitude of the spill and upon the dispersal behavior of the oil under varying conditions of ice coverage. (Sinha-OEIS).
W79-05886

THE DISTRIBUTION, ABUNDANCE AND FEEDING ECOLOGY OF BIRDS ASSOCIATED WITH PACK ICE,
Point Reyes Bird Observatory, Stinson Beach, CA.
G. J. Divoky, R. Boekelheide, E. Good, K. Hirsch, and H. Huber.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol II, Receptors--Birds, p 167-509, October 1978. 235 fig, 15 tab, 18 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 02-7-022-35410.

Descriptors: *Birds, *Ecology, *Abundance, *Ice, Oil pollution, Water pollution effects, Resources development, Environmental effects, Baseline studies, Alaska, *Outer Continental Shelf, *Pack ice, *Critical habitats, Bering Sea, Beaufort Sea, Petroleum development, Seabirds.

As part of an environmental assessment of the outer continental shelf of Alaska the distribution, abundance and feeding ecology of seabirds associated with pack ice are being studied. Birds in the Bering Sea are feeding primarily on fish and zooplankton associated with a deep warm water layer. The presence of deep warm water may be important in determining which areas are important to large numbers of birds. In the Beaufort shoreline migrants are feeding primarily on zooplankton while pelagic species are feeding on fish. For purposes of oil development all areas within 20 km of shore in the Beaufort can be considered critical habitat. The ice environment of the Bering, Chukchi and Beaufort seas will present problems unique to the exploitation of oil and gas reserves under these waters. Technical means have not been developed to keep moving pack ice from affecting oil platforms. Underwater pipelines transporting oil to the mainland will be in danger of rupture by keels on ice floes. For these and a number of other reasons, the occurrence of an oil spill or similar major disturbance is more likely in the pack ice than in ice-free waters. (Sinha-OEIS)
W79-05887

ECOLOGICAL STUDIES IN THE NORTHERN BERING SEA: BIRDS OF COASTAL HABITATS ON THE SOUTH SHORE OF SEWARD PENINSULA, ALASKA,
College of the Atlantic, Bar Harbor, ME.
W. H. Drury, J. O. Biderman, J. B. French, Jr., and S. Hinckley.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol II, Receptors--Birds, p 510-613, October 1978. 22 fig, 22 tab. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35208.

Descriptors: *Birds, *Ecology, *Habitats, *Biology, Alaska, Oil pollution, Water pollution effects, Baseline studies, Environmental effects, Resources development, *Outer Continental Shelf, Bering Sea, Seward Peninsula, Wildfowl, Food supply, Petroleum development.

Those aspects of the biology of wildfowl which deserve careful consideration in order to avoid unnecessary damage in the course of development associated with the extraction of oil are identified. The objectives are to locate major concentrations of seabirds, waterfowl and shorebirds in space and time; to establish the numbers involved and the circumstances under which the gathering areas are important; to learn the relation of selected species of seabirds to the oceanic ecosystems by measuring the birds' reproductive rates and food dependencies; and to investigate the relation of biologically important areas to the geography and ecology of the Northern Bering Sea, such as location of nesting cliffs, feeding grounds at sea, and tundra nesting habitats, as well as those wetlands and mudflats which are used for feeding and escape from hunting pressure. The studies indicate that both Black-legged Kittiwakes and Common Murres are sensitive to changes in the food supply available in Norton Sound. Thus they offer the possibility of acting as indicator species for negative changes in the trophic structure of the sea. Studies also suggest that Ravens and Glaucous Gulls may act as indicator species, but of a different sort. These two species seem to benefit from organic wastes supplied by humans and thus to benefit from development. The contrast in the effects of development offered by these two pairs of species indicates that it may be dangerous to assign a priori, definite boundaries to the relation between a given species and what we consider to be its habitat or ecosystem. (Sinha-OEIS)
W79-05888

DISTRIBUTION AND ABUNDANCE OF MARINE BIRDS - SOUTH AND EAST KODIAK ISLAND WATERS,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
C. J. Lensink, P. J. Gould, C. S. Harrison, and D. Forsell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol II, Receptors--Birds, p 614-710, October 1978. 29 fig, 28 tab, 41 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Birds, *Abundance, *Habitats, *Temporal distribution, *Spatial distribution, Alaska, Water pollution effects, Baseline studies, Oil spills, Environmental effects, Resources development, *Outer Continental Shelf, *Ecological distribution, Food supply, Kodiak Basin, Petroleum development.

This project is designed to provide information on the seasonal distribution and abundance of birds in Alaska's marine habitats. The most important factors influencing marine bird distribution and density appear to be: (1) location of suitable breeding areas, (2) physical characteristics of the surface water (salinity, tide rips, etc.), (3) availability of suitable food, (4) bottom topography, (5) reproductive status of the birds, and (6) location of extensive fishing and fish processing operations. Data on distribution and abundance of marine birds indicates that vast numbers of birds are 'at risk' to pollution of Alaska's marine habitats. The kinds and numbers of birds involved will vary greatly in time and space but high impact levels, at least on a short-term basis, are inevitable. Each bird species will have a varying and unique degree of vulnerability to pollution (e.g., oil spills) depending on, in part, the following factors: (1) species spending more time in the water than in the air are the most vulnerable, (2) species forming large dense flocks are more vulnerable than less gregarious species, (3) species breeding in the area are more vulnerable than nonbreeding species because productivity is affected, (4) some species are rarer than others and thus are more vulnerable because of the reduced possibility of rebuilding populations by immigration from other areas, (5) year-round residents are more vulnerable to local pollution problems than seasonal residents and migrants, (6) species preferring areas of entrained water are more vulnerable than species which prefer areas of strong currents, and (7) species going through a flightless period at-sea (e.g., heavy molt or precocial young) are more vulnerable than species capable of year-round flight. (Sinha-OEIS)
W79-05889

AVIAN COMMUNITY ECOLOGY AT TWO SITES ON ESPENBERG PENINSULA IN KOTZEBUE SOUND, ALASKA,
Alaska Univ., Fairbanks. Inst. of Arctic Biology.
P. G. Mickelson, D. Shamel, and D. Tracy.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol II, Receptors--Birds, p 711-750, October 1978. 7 tab, 2 ref, 21 charts. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Birds, *Ecology, *Phenology, *Data, Alaska, Environmental effects, Baseline studies, Resources development, Water pollution effects, *Outer Continental Shelf, Kotzebue Sound, Ecological distribution, Petroleum development, Cape Espenberg(AK).

The objective of this project were: to determine phenology of events from spring arrival through departure of birds; to determine the distribution and abundance of birds and their predators; to describe habitat utilization of birds and their predators during migration, the nesting season, and the brood rearing season; to estimate production of all avian species nesting on Cape Espenberg; to determine the abundance of small mammals which are utilized by avian and mammalian predators; to describe availability of food and utilization by shorebirds; to determine distribution and abundance of sea mammals; to provide recommendations to lessen the impact of developments on the avian community and avian habitat at Cape Expenberg; to establish baseline study plots to evaluate the impact of developments on the avian community and avian habitat at Cape Espenberg; and to assess bird use of coastal habitats in southern Kotzebue Sound by flying aerial surveys at regular intervals. In this brief report only those data products included are: small mammal abundance, bird measurements, birds banded, and daily bird observations. (Sinha-OEIS)
W79-05890

ECOLOGICAL STUDIES IN THE NORTHERN BERING SEA: STUDIES OF SEABIRDS IN THE BERING STRAIT,
College of the Atlantic, Bar Harbor, ME.
W. H. Drury, and J. O. Biderman.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol II, Receptors--Birds, p 751-838, October 1978. 16 fig, 13 tab. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35208.

Descriptors: *Birds, *Ecology, *Baseline studies, *Alaska, Aircraft, Water pollution effects, Resources development, Environmental effects, Reproduction, *Outer Continental Shelf, Bering Strait, Seabirds, Food supply, Petroleum transport, Ecological distribution.

In the area between Cape Lisburne and Saint Lawrence Island there are 3,725,000 to 4,000,000 seabirds. Little Diomede Island, the subject of this study, is a major seabird colony and the northernmost nesting colony of Parakeet, Crested and Least Auklets. Drastic population reduction or steady declines are possible results of development. It has been suggested that populations be reduced at experimental colonies in order to establish the rate of recovery. Although the evidence is not clear, there is a suggestion that numbers of murres at Little Diomede Island have decreased since the late 1950s. If real, a decrease is consistent with the decrease of murres observed during the same period at Cape Thompson. Similarly, there is evidence that the numbers of Crested Auklets have decreased, which would be consistent with the reports to that effect by Orville Ahkinga and John Ayapana of Ignalook. It is generally believed that arctic birds are subjected to stress by the extra effort required for breeding. Any further stress introduced by the impacts of development upon their food sources are likely to cause some degree of reproductive failure. An important aspect of OCSEAP is defining differences in biological oceanographic structures of the Bering Sea. Disturbance by the chronic effects of through traffic, by secondary effects such as helicopter operations and coastal development, by direct damage from oil spills or by indirect effects on the food of the seabirds will affect an area that is comparable to the plains of East Africa among the major natural wonders of the world. (Sinha-OEIS)
W79-05891

ECOLOGICAL STUDIES OF COLONIAL SEABIRDS AT CAPE THOMPSON AND CAPE LISBURNE, ALASKA,
Renewable Resources Consulting Services, Ltd. Fairbanks, AK.
A. M. Springer, and D. G. Roseneau.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol II, Receptors--Birds, p 839-960, October 1978. 28 fig, 50 tab, 16 ref. NOAA, Outer Continental Shelf Environmental Asssessment Program, Boulder, Colorado. 03-6-022-35210.

Descriptors: *Birds, *Ecology, *Water pollution effects, *Environmental effects, Oil spills, Resources development, Exploration, Alaska, *Outer Continental Shelf, Chukchi Sea, Seabirds, Petroleum development, Terminal facilities, Ecological distribution, Food supply, Foraging.

The colonies at Cape Thompson and Cape Lisburne support most of the breeding seabirds in the eastern Chukchi Sea. The birds constitute a major component of the ecosystem in this region. Perturbations of the environment by resource development in the Hope Basin could threaten the health and stability of these seabird populations. The birds nesting at Cape Thompson, Cape Lisburne and Cape Lewis could be threatened by OCS development in several ways. Spills south or west of Cape Thompson, Cape Lisburne and Cape Lewis would be driven closer to these colonies or onto their beaches by prevailing southerly and westerly winds. High velocity northerly winds, also prevalent in the area, could, on the other hand, prevent oil from reaching the colonies themselves if all conditions were right. Because of the currents and wind patterns in the region, however, floating oil will almost certainly impinge upon foraging areas whether or not it actually reaches the coastline. At Cape Thompson floating oil originating from spills in the northern Bering Strait or southern Chukchi Sea may offer the greatest potential danger to the colony. The Cape Thompson colonies also are located at a point potentially attractive for use during exploration activities, and more importantly, for construction of a major marine terminal. Increased human activity could cause a variety of disturbances that may adversely influence the reproductive success of several species. (Sinha-OEIS)
W79-05892

POPULATION DYNAMICS AND TROPHIC RELATIONSHIPS OF MARINE BIRDS IN THE GULF OF ALASKA AND SOUTHERN BERING SEA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
S. A. Hatch, D. R. Nysewander, A. R. DeGange, M. R. Petersen, and P. A. Baird.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol II, Receptors--Birds, p 1-68, October 1978. 13 fig, 1 tab. NOAA, Outer Continental Shelf Environmental Assessment Program. 01-5-022-2538.

Descriptors: *Birds, *Oil spills, *Water pollution effects, *Environmental effects, Baseline studies, Habitats, Resources development, *Outer Continental Shelf, Gulf of Alaska, Bering Sea, Ecological distribution, Foraging areas.

Site-specific studies of marine birds were conducted at 8 locations in the Gulf of Alaska and southern Bering Sea during the 1977 field season. Studies at 6 locations focused on traditional 'seabird' while two studies focused primarily on shorebirds and waterfowl. The most visible of potential impacts on birds from OCS development will be the death and littering of beaches with carcasses of oiled birds as a result of catastrophic oil spills from platforms, pipelines, terminal and storage facilities and tankers. A second category of direct impacts may result from human disturbances associated with human occupation and of transportation and construction activities near nesting habitats or foraging areas. Because of the large populations of birds in water adjacent to Alaska, which exceed the total of birds in the remainder of the northern hemisphere, losses resulting from an oil spill off the coast of Alaska may be much larger than ever before experienced. Indirect impacts such as occur through contamination or reduction of food resources, causing lower survival or reproductive rates may, however, be even more important, as such changes may result in long term reduction in populations or preclude recovery of populations subjected to losses from oil spills. (Sinha-OEIS)
W79-05893

AVIFAUNAL ASSESSMENT OF NELSON LAGOON, PORT MOLLER, AND HERENDEEN BAY, ALASKA - 1977,
Fish and Wildlife Service, Anchorage, AK. Of

f Biological Services and Coastal Ecosystems. . Gill, M. Petersen, C. Handel, J. Nelson, and A. DeGange.
n: Environmental Assessment of the Alaskan Con- inental Shelf. Annual Reports of Principal Investi- ators for the Year Ending March 1978, Vol III, Receptors--Birds, p 69-131, October 1978. 14 fig, 1 ref, 3 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-05-022-2538.

Descriptors: *Birds, *Oil pollution, *Water pollu- ion effects, Alaska, Minerals, Environmental ef- ects, Resources development, *Outer Continental Shelf, Deepwater ports, Germinal facilities, Popu- ation dynamics, Trophic relationships, Gulf of Alaska, Bering Sea, Nelson Lagoon complex.

This report is part of a study of the population ynamics and trophic relationships of marine birds n the Gulf of Alaska and southern Bering Sea. The Nelson Lagoon complex is the largest estuar- ne area along the Bristol Bay shoreline. It supports diverse avifauna found nowhere else along the Alaska Peninsula. While the value of the Alaska Peninsula terrace as a breeding area can not be ismissed, its overwhelming importance is that of a taging area for migratory, post-breeding and win- ering birds. The productivity of many of these agoons far exceeds that of equivalent areas of the djacent Bering Sea. The vast meadows of aquatic egetation and super abundant benthic faunas reate an ideal situation for migratory, molting and vintering birds to obtain the energy reserves eeded to sustain them through these demanding rocesses and periods. The physiographic nature of he estuarine areas, coupled with post-breeding hanges in social structure, force birds into much reater concentrations than found on the breeding rounds. Because of this, the birds become ex- remely vulnerable to oil contamination from off- hore and onshore spills. Similarly, onshore devel- pments in support of mineral exploitation pose an qual threat and should be strictly regulated. The elatively deepwater port capabilities and associat- d developments of Port Moller have, equal or reater potential impact to waterbird populations han those associated with offshore development nd spills. (Sinha-OEIS)
W79-05894

BREEDING AND POPULATION ECOLOGY OF FULMARS AT SEMIDI ISLANDS, ALASKA, WITH OBSERVATIONS ON THE REPRODUC- TION OF SYMPATRIC SEABIRD SPECIES,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems. S. Hatch.
In: Environmental Assessment of the Alaskan Con- tinental Shelf. Annual Reports of Principal Investi- gators for the Year Ending March 1978, Vol III, Receptors--Birds, p 132-207, October 1978. 29 fig, 13 tab, 11 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-2538.

Descriptors: *Birds, *Breeding, *Phenology, *Re- production, Ecology, Baseline studies, Environ- mental effects, Water resources, Water pollution effects, Resources development, Alaska, *Outer Continental Shelf, *Food supply, Population struc- ture, Ecological distribution, Gulf of Alaska, Semidi Islands.

A population of some 475,000 Northern Fulmars occupy over 40 miles of coastline at Semidi Islands during the breeding season. In 1977 egg-laying spanned the period 2-21 June, hatching occurred from 20 July - 8 August and fledging probably began about 10 September with the last young Fulmars departing during the first week in Octo- ber. Nesting phenology was four days later in this year than in 1976. Reproductive success was 51% for 386 breeding pairs, representing more than a three-fold increase over production in the 1976 season. Associated with the higher level of breed- ing success were a less pronounced pre-laying exodus, shorter incubation shifts and earlier initi- tion of molt in unemployed birds, each of which suggests greater food availability in 1977. There appears to be a critical period around the time of egg-laying when food supply and the nutritional status of breeding birds largely determines the outcome of the season's nesting effort. Information on the foraging range and feeding areas of Fulmars breeding at Semidi Islands is needed, and could best be obtained through coordinated onshore and aerial observations. An open nesting habit, high degree of fidelity to nest-site and mate and individual variation in body color render the Fulmar at Semidi Islands uniquely suited to a study of the dynamics of population structure and productivity. Observations on phenology and production in other seabirds breeding at Semidi Islands indicated that, for most species, the timing of breeding was very similar while reproductive success was higher in 1977 compared to the previous year. The dynamics of nest-site ownership and breeding status may be very relevant from the standpoint of predicting population responses of Fulmars to environmental disturbance. (Sinha-OEIS)
W79-05895

STUDIES OF MARINE BIRDS ON UGAIUSHAK ISLAND,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems. D. H. S. Wehle.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol III, Receptors--Birds, p 208-312, October 1978. 42 fig, 25 tab, 2 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-2538.

Descriptors: *Birds, *Ecology, *Environmental effects, Oil pollution, Water pollution effects, Resources development, Baseline studies, Alaska, *Outer Continental Shelf, *Population structure, *Ecological distribution, Seabird colonies, Food supply, Petroleum development, Gulf of Alaska, Ugaiushak Island.

The Ugaiushak Island seabird colony is a part of a large complex of colonies included in the proposed Shumagin Islands National Wildlife Refuge. Birds from these colonies would be vulnerable to any extensive pollution by oil in the Western Gulf of Alaska such as may occur with the development of petroleum in Kodiak Basin. This study of populations and ecology of the marine avifauna of Ugaiushak Island continues studies conducted on this island in 1974 and 1976. A great deal of variation was observed between 1976 and 1977 in several aspects of the reproductive ecology of most seabird species studied. Although the reasons for the variation observed are unknown, it is believed that availability of food resources is probably the most important single factor. (Sinha-OEIS)
W79-05896

THE BREEDING BIOLOGY AND FEEDING ECOLOGY OF MARINE BIRDS IN THE SITKALIDAK STRAIT AREA, KODIAK ISLAND, 1977,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems. P. A. Baird, and R. A. Moe.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. III, Receptors--Birds, p 313-524, October 1978. 86 fig, 77 tab, 16 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-2538.

Descriptors: *Birds, *Breeding, *Ecology, *Environmental effects, *Oil spills, Alaska, Resources development, Baseline studies, Water pollution effects, *Outer Continental Shelf, *Food supply, Feeding, Kodiak Island.

The purpose of the study at Sitkalidak Strait, Kodiak Island, Alaska was to collect information on the breeding biology and feeding ecology of five major species of birds: Black-legged Kittiwakes, Tufted Puffins, Arctic and Aleutian Terns, and Glaucous-winged Gulls. This information is necessary in order to assess the pre-drilling avian ecology at Sitkalidak. Areas of the Outer Continental Shelf nearby are soon to be drilled and until this study, there had been no ecological assessment of the avifauna in the area. The most obvious danger of offshore oil development in the Kodiak waters are oil spills. The vulnerability of seabirds to such spills has been well documented. One effect of oil spills in the marine environment is a decrease in the available food supply because of the depth or contamination of prey species which have succumbed to or have accumulated the toxic fractions of oil. Another is the buildup of toxic hydrocarbons in the birds themselves as a result of the ingestion of contaminated prey. Any oil slicks in the Sitkalidak Strait area during May through September could also have a direct effect on the seabirds by oiling any birds rafting off the colonies or feeding in the strait. Convergence lines and tide rips were found to be important feeding areas for all species, and it is here that much of the oil would accumulate, presenting a serious threat. Onshore development and shipping activities also should not be close enough to existing colonies to cause abnormal disturbances to the nesting birds. (Sinha-OEIS)
W79-05897

THE BREEDING BIOLOGY OF MARINE BIRDS ASSOCIATED WITH CHINIAK BAY, KODIAK ISLAND, 1977,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems. D. Nysewander, and E. Hoberg.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol III, Receptors--Birds, p 525-574, October 1978. 9 fig, 17 tab, 27 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-2538.

Descriptors: *Birds, *Biology, *Breeding, *Food chains, *Baseline studies, *Ecology, Alaska, Oil spills, Water pollution effects, Resources development, Environmental effects, *Outer Continental Shelf, Kodiak Island, Petroleum transport, Ecological distribution.

Lease sales are imminent for many portions of the continental shelf areas surrounding Kodiak Island. The town of Kodiak and parts of Chiniak Bay are slated to be staging and resupply areas. Two Kodiak oil spills in January and March 1970 have already indicated what adverse impacts offshore shipping can have: at least 10,000 birds died with the possibility of 100,000 birds having been killed. If marine birds are valid indication of the health of the food chain and there is increasing evidence to support this concept, then it is essential to continue expanding baseline data and monitoring studies of the marine birds in the region. Chiniak Bay offers some unique opportunities to develop some baseline data on breeding biologies of marine birds that have no published data on them. The lack of predators makes feasible the study of both the Pelagic and Red-faced Cormorants. The presence of Aleutian Tern colonies and an unusual Mew Gull colony afford similar opportunities. One of the critical times for marine birds in Chiniak Bay is the winter when numerous waterfowl and alcids frequent the bay. (Sinha-OEIS)
W79-05898

DYNAMICS OF MARINE BIRD POPULATIONS ON THE BARREN ISLANDS, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems. D. A. Manuwal, and D. Boersma.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol III, Receptors--Birds, p 575-679, October 1978. 29 fig, 35 tab, 146 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-2538.

Descriptors: *Birds, *Baseline studies, *Oil pollution, Alaska, Water pollution effects, Food chains, Currents, Environmental effects, Resources development, *Outer Continental Shelf, Barren Islands, Petroleum transport.

The Barren Islands project was designed to gather baseline information on seabirds which would be useful in determining the human use and management requirements necessary for maintaining the present seabird population. The Barren Islands with their sizable seabird and marine mammal populations could sustain severe damage from oil because of its current regime. Tidal variation is great and fishermen regard the islands as some of the more hazardous fishing areas because of the strong tidal currents and frequent storms. Oil coming to the islands is likely to be widely disbursed. Because of the currents and winds, cleanup equipment can generally be considered useless in the Barren Islands. The rocky beaches and kelp beds characteristic of the islands also make them particularly sensitive to oil. These areas act as traps where toxicities build up but are not easily flushed. To make matters worse, the least damaging mechanical cleanup method is impossible to use in these areas. The extent of damage on the habitat or physiography of an area will depend on the oil type, oil dosage, oceanographic conditions, meteorological conditions and turbidity. (Sinha-OEIS)
W79-05899

COMMUNITY STRUCTURE OF SEABIRDS OF WOODED ISLAND, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
P. G. Mickelson, W. Lehnhausen, and S. E. Quinlan.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. III, Receptors--Birds, p 680-772, October 1978. 11 fig, 20 tab, 37 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-2538.

Descriptors: *Birds, *Oil pollution, *Baseline studies, *Water pollution effects, Alaska, Ecosystems, Environmental effects, Oil spills, *Outer Continental Shelf, Gulf of Alaska, Petroleum transport, Wooded Islands.

Information was obtained about the breeding distribution, abundance, phenology, and productivity of seabirds using Wooded Island in the Gulf of Alaska. Major seabird species on Wooded Islands, and those discussed in this report are: Tufted Puffins, Fork-tailed Storm Petrels, Black-legged Kittiwakes, Leach's Storm Petrels, Glaucous-winged Gulls, Cormorants (Double-crested, Pelagic, and Red-faced), Pigeon Guillemots, Common Murres, Parakeet Auklets, and Horned Puffins. Wooded Islands may become an attraction to tourists and residents of Alaska because of their accessible location and the variety of breeding seabirds and marine mammals they harbor. Wooded Islands and the surrounding waters are threatened with oil pollution in the near future. Outer Continental Shelf oil and gas exploration has already begun in the northern Gulf of Alaska. Oil tankers are carrying crude oil south by Wooded Islands from the Valdez terminal of the Trans-Alaska oil pipeline. The effects of oil spills on Wooded Islands seabirds and other birds using the area depends largely upon the amount of oil spilled, the time of year of the spill, the stage of tides, wind velocity when oil reaches Wooded Islands area, and the success of clean-up measures. In summary, oil spills can produce a variety of direct and indirect effects which reduce the survival of birds. All possible caution should be used to minimize the probability of a large oil spill. Chronic low level oil pollution especially should be minimized. It is potentially more dangerous to the ecosystem than catastrophic spills since food organisms may concentrate hydrocarbons and remain contaminated for several years. (Sinha-OEIS)
W79-05900

THE FEEDING ECOLOGY AND TROPHIC RELATIONSHIPS OF KEY SPECIES OF MARINE BIRDS IN THE KODIAK ISLAND AREA, MAY-SEPTEMBER 1977,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
G. Sanger, V. F. Hironaka, and A. K. Fukuyama.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol III, Receptors--Birds, p 773-848, October 1978. 46 fig, 7 tab, 20 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-2538.

Descriptors: *Birds, *Ecology, *Ecosystems, *Food chains, *Baseline studies, Alaska, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, *Feeding habits, *Trophic relationships, Ecological distribution, Kodiak Island.

This study was conducted in the general area off northeastern Kodiak Island, from Marmot Bay south to the Geese Islands, and over the shelf to about 45 km offshore of the major headlands. Bird collections for feeding habits studies were concentrated in and offshore from Marmot and Chiniak Bays in the north, and in the area around Sitkalidak Island in the south. A total of 428 specimens of the five key species was collected in this study. These are summarized by species, cruise period and general area of collection. The possibility of the kind of prey influencing the physiological condition of birds, such as suggested by the amount of euphausiids in the diet of Short-tailed Shearwaters influencing their fat index, suggests that an understanding of the biomass of prey consumed only tells part of the story of trophic relationships. The energy value of different prey, as well as their assimilation rates in the birds, will have to be understood before trophic relationships can be understood beyond the preliminary level presented here. (Sinha-OEIS)
W79-05901

CATALOG OF ALASKAN SEABIRD COLONIES,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
A. Sowls.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. III, Receptors--Birds, p 849-856, October 1978. 6 fig, NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-2538.

Descriptors: *Birds, *Alaska, *Ecosystems, *Data collections, Baseline studies, Resources development, Environmental effects, Water pollution effects, *Outer Continental Shelf, *Catalogs, Seabird colonies.

The objective of the colony catalog is to provide information on location, species composition and populations for Alaskan seabird colonies. Data are organized for quick access at whatever level is needed for management and scientific queries. The system includes a file containing the original data, references and maps, and photographs when they are available. This file is located in the Anchorage office of the U.S. Fish and Wildlife Service, Office of Biological Services - Coastal Ecosystems. A computer format was devised for colony catalog data but has not yet been digitized. This report presents an update on the preparation of the final catalog, a statewide summary of three seabird species and recommendations for further study. (Sinha-OEIS)
W79-05902

SURVEY OF BEACHED MARINE BIRDS IN ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
K. D. Wohl.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. III, Receptors--Birds, p 857-876, October 1978. 1 fig, 4 tab, 52 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-033-2538.

Descriptors: *Birds, *Mortality, Surveys, *Baseli
studies, *Alaska, Water pollution effects, Enviro
mental effects, Resources development, *Out
Continental Shelf, *Beached birds, Gulf of Alas

There are no direct means for measuring mortali
of marine birds except during the short period th
are congregated on their breeding sites. Maj
sources of mortality are a matter of conjecture a
many incidents of mass mortality likely go unc
tected. However, since carcasses of birds a
mammals float and are relatively durable, they a
frequently washed ashore following their death
sea. It follows that their appearance on coas
beaches provides an indication of the tempor
and geographic patterns of normal mortality
well as evidence of the character of hazards affe
ing the survival of these animals. One of the obj
tives of the beached marine bird and mamm
survey program are to establish a temporal, spati
and frequency index of normal mortality as e
denced by observing dead birds and mammals
selected beaches in the northern Gulf of Alas
Surveys of beached marine birds and mammals
conducted on as regular a basis as weather w
permit at 15 locations in the northern Gulf
Alaska - four in Lower Cook Inlet, four in Nor
eastern Gulf of Alaska and seven in northw
Gulf of Alaska (Kodiak Island). In addition to
15 year-round survey transects, there are 34 oth
locations, comprising about 84 km in the north
Gulf and Bering Sea regions, where surveys ha
been conducted on an opportunistic basis sin
1974. (Sinha-OEIS)
W79-05903

**NUTRITIONAL SIGNIFICANCE OF COPPE
BERING INTERTIDAL SYSTEM TO SPRIN
MIGRATING SHOREBIRDS BREEDING
WESTERN ALASKA,**
Alaska Univ., Fairbanks. Inst. of Arctic Biolo
S. E. Senner, and G. C. West.
In: Environmental Assessment of the Alaskan C
tinental Shelf. Annual Reports of Principal Inve
gators for the Year Ending March 1978, Vol.
Receptors--Birds, p 877-908, October 1978. 9 fi
tab, 21 ref. NOAA, Outer Continental Shelf En
ronmental Assessment Program, Boulder, Colo
do. 01-5-022-2538.

Descriptors: *Birds, *Migrations, *Intertidal ar
*Baseline studies, *Habitats, Resources devel
ment, Water pollution effects, Environmental
fects, Nutrition, Alaska, *Outer Continental Sh
*Petroleum transport, *Habitat degradation.

In the year ending 1 April 1978, significant n
dimensions were added to an appraisal of
Copper River Delta system as critical habitat
Dunlins and Western Sandpipers in spring mi
tion. Both species appear to be highly suscepti
to any intertidal habitat degradation in the C-B
system, although of the two, the Dunlin show
higher degree of obligate habitat dependency
the C-BRD system itself. By contrast, current
derstanding leads us to regard habitat degradat
in Lower Cook Inlet as at least as serious a th
to westerns as similar events in the Copper-Be
system. Applications of the information obtaine
this study will primarily be used in documentin
refuting the suggested importance of this uni
heavily used geomorphic feature and habitat.
results may be useful in specifically indicating
tective measures by state and federal resource m
agement agencies. Several potentially damag
petroleum-related developments underway or
posed in the northern Gulf of Alaska make th
objectives pertinent, such as marine tanker tr
to and from Valdez daily. (Sinha-OEIS)
W79-05904

**SURVEY OF THE EPIFAUNAL INVER
BRATES OF THE SOUTHEASTERN BER
SEA,**
Alaska Univ., Fairbanks. Inst. of Marine Scie
H. M. Feder, J. Hilsinger, M. Hoberg, S. Jewett
and J. Rose.
In: Environmental Assessment of the Alaskan C
tinental Shelf. Annual Reports of Principal Inv
gators for the Year Ending March 1978, Vol.

Receptors--Fish, Littoral, Benthos, p 1-126, October 1978. 17 fig, 30 tab, 92 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Invertebrates, *Baseline studies, *Resources development, Environmental effects, Water pollution effects, Oil pollution, Alaska, *Outer Continental Shelf, *Ecological distribution, *Trophic relationships, Faunal composition, Faunal abundance, Epifaunal biomass, Bering Sea.

The 1975-76 trawl study considered in this report delineates the major epifaunal species on the eastern Bering Sea shelf in regions of offshore oil and gas concentrations. Data were obtained on faunal composition and abundance which now are baselines to which future changes can be compared. Long-term studies on life histories and trophic interactions should define functional aspects of communities and ecosystems that are vulnerable to environmental damage, and should help determine the rates at which damaged environments can recover. Initial assessment of all data suggests that: sufficient station uniqueness exists to permit development of monitoring programs based on species composition at selected stations utilizing trawl techniques, and adequate numbers of biologically well-known, unique, and/or large species are available to permit nomination of likely monitoring candidates once industrial activity is initiated. (Sinha-OEIS)
W79-05905

THE DISTRIBUTION, ABUNDANCE, DIVERSITY AND PRODUCTIVITY OF THE WESTERN BEAUFORT SEA BENTHOS,
Oregon State Univ., Corvallis. School of Oceanography.
A. G. Carey, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. IV, Receptors--Fish, Littoral, Benthos, p 127-252, October 1978. 34 tab, 2 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-68.

Descriptors: *Benthos, *Ecology, *Temporal distribution, *Spatial distribution, *Baseline studies, Computer programs, Resources development, Water pollution effects, Environmental effects, Food chains, Alaska, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

Extensive exploration and development for oil and gas on the Alaskan and Canadian continental shelf have the potential to significantly influence the marine environment of the Beaufort Sea. The past and continuing goal of this project has been to acquire the knowledge of the ecology of benthic invertebrate faunas of the Beaufort Sea continental shelf necessary to evaluate the consequences of offshore oil and gas development. The distribution and abundance of the fauna has been examined in detail with studies of the spatial and temporal variability of these. These data will provide a baseline against which future changes in the benthic environment and community structure can be evaluated. Of current importance are: (1) the determination of the life histories and secondary production estimates of dominant and ecologically important species, (2) the definition of temporal changes in sublittoral community structure, (3) the description of the benthic food web, and (4) the study of the ecology of benthic invertebrates important as prey organisms to the marine mammals, birds, and fishes. Now that broad ecological patterns of benthic invertebrates on the Beaufort Sea shelf are becoming fairly well known, it is imperative to define the dynamic processes maintaining temporal and spatial structure. Extensive exploratory and production drilling for petroleum has the potential to significantly influence the marine benthic environment and its associated biota. The timing of environmental disturbances in this strongly seasonal environment may be extremely critical in determining the stresses experienced by the benthic community. (Sinha-OEIS)
W79-05906

BASELINE/RECONNAISSANCE CHARACTERIZATION LITTORAL BIOTA, GULF OF ALASKA AND BERING SEA,
National Marine Fisheries Service, Auke Bay, AK. Northwest and Alaska Fisheries Center.
C. E. O'Clair, J. L. Hanson, J. S. MacKinnon, J. A. Gharrett, and N. I. Calvin.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. IV, Receptors--Fish, Littoral, Benthos, p 256-415, October 1978. 80 fig, 6 tab, 59 ref, 3 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Invertebrates, *Aquatic plants, *Baseline studies, *Intertidal areas, Alaska, Water pollution effects, Environmental effects, Oil pollution, Resources development, *Outer Continental Shelf, Gulf of Alaska, Bering Sea, Petroleum development, Mytilus edulis, Fucus distichus.

The distribution and relative abundance patterns of littoral plants and invertebrates at the eighteen representative sites in the eastern Gulf of Alaska are described. The role of an important interaction in intertidal communities, competition for space, especially competition among dominant competitors and accompanying effects on subdominants were examined. Data indicate that total species richness tends to be greater in patches of intertidal area dominated by Mytilus edulis than in patches dominated by Fucus distichus, and that the difference is accounted for by increased species richness of small subdominants in Mytilus dominated areas. Mytilus does not appear to have a greater adverse effect on competitively inferior large subdominants than does Fucus. Pollution by oil and oil dispersants has been shown to produce major changes in the abundances of algae and invertebrates indirectly by temporarily eliminating herbivores which ultimately can delay recolonization for up to 9-10 years. In these studies the most important effect of oil and oil dispersants was the temporary reduction of a key biological interaction, herbivory by limpets and urchins. (Sinha-OEIS)
W79-05907

DISTRIBUTION, ABUNDANCE, COMMUNITY STRUCTURE, AND TROPHIC RELATIONSHIPS OF THE NEARSHORE BENTHOS OF THE KODIAK SHELF, COOK INLET, NORTHEAST GULF OF ALASKA AND THE BERING SEA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
H. M. Feder, M. Hobert, A. J. Paul, J. McDonald, and G. Matheke.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. IV, Receptors--Fish, Littoral, Benthos, p 416-730, October 1978. 30 fig, 22 tab, 14 ref, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Benthos, *Abundance, *Ecology, Alaska, Spatial distribution, Temporal distribution, Environmental effects, Water pollution effects, Resources development, *Outer Continental Shelf, *Ecological distribution, Trophic relationships, Community structure, Gulf of Alaska, Bering Sea, Kodiak Shelf, Cook Inlet.

The operations connected with oil exploration, production, and transportation in the Gulf of Alaska and the Bering Sea present a wide spectrum of potential dangers to the marine environment. Adverse effects on the marine environment of these areas cannot be quantitatively assessed, or even predicted, unless background data are recorded prior to industrial development. Initial assessment of all data suggests that: (1) sufficient station and/or area uniqueness exists to permit development of monitoring programs based on species composition at selected stations utilizing both grab and trawl sampling techniques, and (2) adequate numbers of biologically well-known, unique, abundant, and/or largesspecies are available to permit nomination of likely monitoring candidates for the areas once industrial activity is initiated. Fifty-three permanent stations have been established in two bays of Kodiak Island. Fifty-three permanent stations have been established in two bays of Kodiak Island. Sampling crabs and fishes using trawls and stomach analysis has made it possible to understand a major component (the epifauna) of two Kodiak bays. However, a full comprehension of the benthic systems there will only be achieved when these studies are expanded to include an assessment of infauna as well. Forty-two widely dispersed permanent stations have been established to sample the infauna in the northeastern Gulf of Alaska in conjunction with the physical, chemical, heavy metals and hydrocarbon programs. These stations represent a reasonable nucleus around which a monitoring program can be developed. Seventy-seven widely dispersed permanent stations and seven stations of opportunity have been established in conjunction with the chemical, hydrocarbon, heavy metals, and geological programs in the Bering Sea. (Sinha-OEIS)
W79-05908

RECONNAISSANCE CHARACTERIZATION OF LITTORAL BIOTA, BEAUFORT AND CHUKCHI SEAS,
Western Washington Univ., Bellingham.
A. C. Broad, H. Koch, D. T. Mason, G. M. Petrie, and D. E. Schneider.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. V, Receptors--Fish, Littoral, Benthos, p 1-42, October 1978. 19 tab, 3 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-81.

Descriptors: *Aquatic life, *Aquatic plants, *Baseline studies, Environmental effects, Water pollution effects, Oil pollution, Resources development, Biota, Alaska, *Outer Continental Shelf, *Feeding grounds, Beaufort Sea, Chukchi Sea.

The fauna of the Beaufort littoral (2m depth to shoreline) region is poor in species and biomass and probably is depopulated annually by shore-fast ice. There are, however, resident populations of enchytraeid (Oligochaete) worms and chironomid (midge) larvae that must, somehow, be frozen in during the winter. The former, although numerous, account for very little total biomass. Their ecological role is unknown. The latter are fed upon by important anadromous fishes. The Beaufort nearshore (+2m to 20m) is a refugium from which the littoral region is repopulated annually. The fauna of the nearshore region is intermediate in species diversity and biomass between the littoral and close offshore regions. The fauna of the Beaufort littoral/nearshore and the Chukchi littoral north of Point Hope are similar in species, diversity, and biomass. Plant communities of Arctic Alaskan beaches may be categorized in eight major types. The most common lower beach communities (mainly combinations of the grass, Puccinellia phrygonodes and sedges of the genus Carex) may be called salt marshes. These marshes are important feeding areas for geese, brant, shorebirds, and to some extent caribou. Carex species and other beach plants contribute significantly to soil stability and probably resist shoreline erosion. Oil in low quantities adversely affects in a single season the growth of Carex in salt marshes. Sand drift which may accompany beach erosion adversely affects growth of arctic salt marsh plants. (Sinha-OEIS)
W79-05909

PLANT COMMUNITIES OF ALASKAN ARCTIC BEACHES,
Western Washington Univ., Bellingham.
R. J. Taylor.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the year Ending March 1978, Vol. V, Receptors--Fish, Littoral, Benthos, p 43-60, October 1978. 4 fig, 9 tab. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-81.

Descriptors: *Aquatic plants, *Habitats, *Beaches, *Salt marshes, Baseline studies, Arctic Ocean, Alaska, Erosion, Environmental effects, Resources

development, Dunes, *Outer Continental Shelf, *Beaufort Sea, *Ecological distribution, Elymus mollis, Chukshi Sea.

Arctic Alaskan shorelines can be divided into six very general habitat-types. Plant communities of each of these habitat-types are rather consistent in occurrence and similar in structure. It was noted that the major distinction between the shoreline communities of the Chukchi and Beaufort Seas resulted more from the ratio of habitat-types than from localized distribution of representative species. For example, wide gravelly beaches with Elymus mollis communities were especially common along the Chucki Sea whereas mud flats with salt marsh vegetation were more frequent along the Beaufort Sea. The plant ecology and floristics of the six habitat-types are discussed. (Sinha-OEIS)
W79-05910

PRELIMINARY INVESTIGATIONS OF TROPHIC RELATIONSHIPS OF THE ARCTIC SHALLOW WATER MARINE ECOSYSTEM,
Western Washington Univ., Bellingham.
D. E. Schneider, and H. Koch.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. V, Receptors--Fish, Littoral, Benthos, p 61-84, Oct. 1978. 4 fig, 4 tab, 3 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder Colorado. 03-5-022-81.

Descriptors: *Plankton, *Benthos, *Primary productivity, *Baseline studies, *Arctic Ocean, *Ecosystems, Alaska, Peat, Resources development, Environmental effects, Water resources, *Outer Continental Shelf, *Trophic relationships.

Preliminary work on trophic relationships has established that primary production by planktonic and benthic microalgae is an important energy input for the Arctic shallow water marine ecosystem. Presumably this input is most important during late spring and summer months, however low populations of viable algal cells apparently remain available even through the winter months. At least some of the animals in this ecosystem ingest vascular plant and moss fragments (peat) that enter the system from the tundra. Presumably this serves as a secondary energy input, but it is difficult at this time to evaluate the relative importance of primary production and detrital input. Substantial microbial activity is associated with the peat and it seems likely that the larger crustaceans and polychaete worms that ingest peat are actually feeding on these microorganisms. At least, that is the view that has emerged from studies of detritus based systems in temperate zone areas. (Sinha-OEIS)
W79-05911

BEAUFORT SEA PLANKTON STUDIES,
R. A. Horner.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. V, Receptors--Fish, Littoral, Benthos, p 85-142, October 1978. 4 fig, 9 tab, 68 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-78-B01-6.

Descriptors: *Plankton, *Ecosystems, *Arctic, *Baseline studies, Life history studies, Water pollution effects, Environmental effects, Oil pollution, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

The objectives of this project are to assess the density distribution and environmental requirements of zooplankton and ichthyoplankton in an array of samples of opportunity and to measure phytoplankton activity. Much of the information concerning the distribution and abundance of plankton in the Beaufort Sea in summer needed to assess the impact of oil development is now available. Only a few studies have been done on the effects of oil on truly Arctic species and on species that contribute measurably to the Arctic marine ecosystem. Potential dangers to the plankton community include reduced primary productivity and possible changes in species composition of the phytoplankton community that might cause changes in zooplankton diversity and therefore affect higher trophic levels. Slow growth and low reproductive rates in the Arctic mean slow recovery following an oil spill. Some life cycle stages, especially larvae, are more susceptible to pollutants than other stages. Thus, if both adults and larvae are destroyed and recruitment from adjacent areas is slow, reestablishment of a community may take considerably longer than in a temperate region. Physical changes in the environment will also affect the organisms living in the Beaufort Sea. Construction of causeways and artificial islands and dredging of channels will change circulation patterns which could affect nutrient supplies and migration and recruitment patterns. Whether these changes will be harmful or beneficial is not known. (Sinha-OEIS)
W79-05912

LOWER COOK INLET MEROPLANKTON,
Washington Univ., Seattle. Dept. of Oceanography.
T. S. English.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol V, Receptors--Fish, Littoral, Benthos, p 146-372, October 1978. 7 fig, 9 tab, 5 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-67-TAB.

Descriptors: *Fishes, *Shellfish, *Plankton, *Temporal distribution, *Spatial distribution, *Fisheries, *Spawning, Alaska, Ecology, Oil pollution, Baseline studies, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, *Cook Inlet, Meroplankton, Petroleum development.

The specific objective of this study was to use MARMAP methods to obtain density distribution maps within seasons of eggs and larvae of fishes and shellfishes of major economic significance in Lower Cook Inlet. Quantitative assessments of spatial and temporal distributions and abundance of economically important fishes and shellfishes are of relevance to problems of petroleum development in Lower Cook Inlet. A resource use conflict in Lower Cook Inlet exists between petroleum development and major fisheries harvests. Spawning areas are close to OCS lease areas; local fishermen and the State of Alaska are uneasy about potential damage to the harvests. Studies of early life history stages are important fishery-independent observations: (1) the earliest life history stages allow an assessment of the magnitude of the spawning population, and (2) later, pre-recruit, life history stages allow an assessment of year class strength before exploitation by the fishery. (Sinha-OEIS)
W79-05913

ASSESSMENT OF POTENTIAL INTERACTIONS OF MICROORGANISMS AND POLLUTANTS RESULTING FROM PETROLEUM DEVELOPMENT ON THE OUTER CONTINENTAL SHELF OF ALASKA,
Louisville Univ., KY. Dept. of Biology.
R. M. Atlas.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VI, Receptors--Microbiology, p 1-84, October 1978. 32 fig, 7 tab. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-85.

Descriptors: *Microbial degradation, *Oil pollution, *Microorganisms, *Ice, Alaska, Water pollution effects, Aromatic compounds, Baseline studies, Resources development, Environmental effects, *Outer Continental Shelf, Beaufort Sea, Gulf of Alaska, Cook Inlet, Petroleum development, Hydrocarbons, Aliphatic compounds.

The main objectives of this study were to characterize microbial populations in Lower Cook Inlet, to determine microbial hydrocarbon biodegradation potentials in Lower Cook Inlet, to study degradation of petroleum under ice in the Beaufort Sea, and to study degradation of petroleum in sediment in the Beaufort Sea. In situ experiments were begun and sampled in Elson Lagoon to determine the fate of oil trapped under ice or in sediment. A new Most Probable Number Procedure was developed for enumeration of hydrocarbon utilizing microorganisms. Hydrocarbon utilizers in Cook Inlet were found in higher numbers in Kachemak Bay, near Kennedy entrance and near Upper Cook Inlet than elsewhere in this area. Hydrocarbon biodegradation potentials in Cook Inlet were lower in November than in April. Hexadecane and naphthalene were utilized to a greater extent than pristane and benzanthracene, indicating the resistance of highly branched and condensed aromatic hydrocarbons to biodegradation. The numbers of viable heterotrophs enumerated in Cook Inlet were very low compared to Beaufort Sea and lower forty-eight coastal waters. The diversities of heterotrophic bacterial communities in Cook Inlet were high, indicative of a pristine area. The numerical taxonomic studies showed that exposure to oil enriched for hydrocarbon utilizers and that mixtures of hydrocarbons were more readily utilized than individual hydrocarbons. The studies indicate that both simple aliphatic and aromatic compounds are degraded by microorganisms indigenous to areas of the Beaufort Sea, Gulf of Alaska and Cook Inlet. (Sinha-OEIS)
W79-05914

STUDY OF MICROBIAL ACTIVITY AND CRUDE OIL-MICROBIAL INTERACTIONS IN THE WATERS AND SEDIMENTS OF COOK INLET AND THE BEAUFORT SEA,
Oregon State Univ., Corvallis. Dept. of Microbiology.
R. P. Griffiths, and R. Y. Morita.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VI, Receptors--Microbiology, p 85-178, October 1978. 26 fig, 23 tab, 22 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sediments, *Nitrogen fixation, *Bacteria, *Oil spills, *Microorganisms, *Microbial degradation, Alaska, Water pollution effects, Environmental effects, Baseline studies, Resources development, *Outer Continental Shelf, Beaufort Sea, Cook Inlet, Crude oil.

During the last year information was obtained about marine microbial function in the Beaufort Sea and Cook Inlet and about the effects of crude oil on specific processes. The mirobial functions primarily concerned relative microbial activity and respiration in surface waters and sediments and rates of nitrogen fixation in the sediments. By both field and laboratory observations the effects of crude oil on these processes were estimated. One of the most important findings concerned the potential incorporation of crude oil into the sediments of Cook Inlet and the Shelikof Strait via surface oil spills in the Upper Cook Inlet. It can no longer be assumed that crude oil spills in Cook Inlet would primarily impact only shoreline communities. There is a very real possibility that this oil could be absorbed onto the suspended particulate matter in the water column and carried to the sediments on the west side of the inlet and into the sediments of the Shelikof Strait. The possible long range effects of this on the biological productivity of Cook Inlet is yet to be determined. (Sinha-OEIS)
W79-05915

DETERMINE THE FREQUENCY AND PATHOLOGY OF MARINE FISH DISEASES IN THE BERING SEA, GULF OF ALASKA, AND BEAUFORT SEA,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
B. B. McCain, H. O. Hodgins, A. K. Sparks, and W. D. Gronlund.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investi-

gators for the Year Ending March 1978, Vol VI, Receptors--Microbiology, p 179-215, October 1978. 14 fig, 2 tab, 15 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Fish diseases, *Pathology, *Water pollution effects, Baseline studies, Alaska, Oil pollution, Environmental effects, Resources development, *Outer Continental Shelf, Gulf of Alaska, Bering Sea, Beaufort Sea.

Four major pathological conditions were found in 6 species of marine fish from the Gulf of Alaska in 1977. The species involved, the type of condition, and the average prevalence and the range of frequencies at the sampling stations of each condition were as follows: Pacific cod (Gadus macrocephalus), pseudobranchial tumors, 2.5% (1.0 to 50%); pollock (Theragra chalcogramma), pseudobranchial tumors, 0.7% (0.3 to 14.3%); rock sole (Lepidopsetta bilineata), epidermal papillomas, 0.2% (0.0 to 0.5%); flathead sole (Hippoglossoides elassodon), epidermal papillomas, 0.4% (1.7 to 16.7%); Pacific ocean perch (Sebastes alutus), epitheloid turmors, 0.6% (0.2 to 21.0%); and Pacific cod, skin ulcers, 0.9% (0.6 to 46.2%). The geographical distribution of all these conditions, except the tumors of Pacific ocean perch, were concentrated in the northwestern Gulf of Alaska, east and northeast of Kodiak Island. All of the tumors had in common the presence of tumor-specific cells known as X-cells which suggests a common etiology. Possible causes of these tumors include a virus(es), natural or man-made toxic chemical(s), or a single-celled parasite. In the aftermath of possible incidents of crude oil contamination of the Gulf of Alaska, the finding of high frequencies of diseased fish alone will not be sufficient to show the harmful effects of oil. Information has been gained concerning which species are particularly susceptible to diseases and which diseases seem closely correlated or not correlated with man's activities. (Sinha-OEIS)
W79-05916

BERING SEA ICE EDGE ECOSYSTEM STUDY: NUTRIENT CYCLING AND ORGANIC MATTER TRANSFER,
Alaska Univ., Fairbanks. Inst. of Marine Science.
V. Alexander, and R. T. Cooney.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. VI, Receptors--Microbiology, p 216-294, October 1978. 11 fig, 16 tab, 13 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Phytoplankton, *Ice, *Ecosystems, *Primary productivity, *Water pollution effects, Oil pollution, Environmental effects, Resources development, Baseline studies, Alaska, *Outer Continental Shelf, Bering Sea.

The objectives of this study were to determine the seasonal and spatial dynamics of the Bering Sea phytoplankton production in areas subject to future OCS development, with emphasis on the ice-edge community. The tremendous primary productivity of the Bering Sea is confined to a relatively short productive period of ice free conditions prior to the onset of low light conditions of fall and winter. Under certain conditions the bloom is very intense for an extremely short period of time during which the water column is stripped of nutrients, and at least over the major area of the shelf, most of the production occurs during a 3-4 week period. The major effects of the ice field appear to be in limiting light energy to the water column and reducing windmixing at the surface. This means that water column plant production is probably negligible until the pack begins to break up. While loose ice is present at the sea surface (in the retreating edge zone) it tends to stabilize the windmixed layer and hence, greatly enhances the opportunity for rapid plant production. The very cold ice-related water tends to sink away from the surface as warming progresses. Evidence is presented that algal populations also sink with the water mass. The ramifications of oil contamination are obvious, particularly since a surface spill could become incorporated and carried to depth with the sinking algal cells to enter benthic food webs on the sea bed. (Sinha-OEIS)
W79-05917

REPORT ON ZOOPLANKTON COMMUNITY GRAZING EXPERIMENTS CONDUCTED ON BOARD THE NOAA SHIP, DISCOVERER, IN THE BERING SEA, MAY-JUNE 1977,
Alaska Univ., Fairbanks. Inst. of Marine Science.
L. Molot.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. VI, Receptors--Microbiology, p 295-323, October 1978. 9 fig, 2 tab, 1 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-033-56.

Descriptors: *Zooplankton, *Ecosystems, *Nutrients, Baseline studies, Environmental effects, Ice Alaska, Data collections, *Outer Continental Shelf, *Ecological distribution, Community grazing.

Two types of grazing experiments were performed during a cruise to the Bering Sea outer continental shelf in May and June 1977, one monospecific, using various herbivorous species, and the other using natural assemblages. The algae blooms at stations 9, 10, 26 and 27 occurred within the broken ice of the receding ice edge. The blooms were primarily diatoms with peak diameters in the window 51-64 micro m. The bloom at station 39, which occurred much farther south in the open water near Unimak Pass, was primarily Haptophyta (Phaeocystis sp.) with a peak diameter in the window 5-6.3 micro m. Grazing rates of particles 4-10 micro m at station 39 could not be calculated due to high background counts induced by line voltage surges. (Sinha-OEIS)
W79-05918

BIBLIOGRAPHY ON THE TRANSFER OF SYNTHESIZED ORGANIC MATTER TO ZOOPLANKTON, MICRONEKTON, AND ICHTHYOPLANKTON,
Alaska Univ., Fairbanks. Inst. of Marine Science.
V. Alexander, and R. T. Cooney.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. VI, Receptors--Microbiology, p 324-468, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-5-022-56.

Descriptors: *Bibliographies, *Plankton, *Baseline studies, Alaska, Nutrients, Water pollution effects, Oil pollution, Environmental effects, Resources development, Primary production, *Outer Continental Shelf, Bering Sea, Chukchi Sea, Gulf of Alaska.

The finished product goes beyond the original task description with the inclusion of references on the following subjects: uptake of organic and inorganic nutrients by primary producers; primary production; trophic interactions, distribution, and population dynamics of marine mammals and seabirds; trophic interactions, population dynamics, and distribution of benthic invertebrates and fishes; the taxonomy and ecology of parasites, of invertebrates and vertebrates; and microbial decomposition of marine organic matter. In general, most of the references apply primarily to the Bering Sea, Chukchi Sea, and northern north Pacific Ocean (with the Kurile-Kamchatka Trench as a southern boundary in the west and the Gulf of Alaska as a southern boundary in the east). The bibliography is arranged alphabetically by author. (Sinha-OEIS)
W79-05919

NUTRIENT DYNAMICS IN NEARSHORE UNDER-ICE WATERS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. M. Schell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VI, Receptors--Microbiology, p 469-496, October 1978. 4 fig, 1 tab, 14 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 3-5-022-56.

Descriptors: *Plankton, *Nutrients, *Energy, *Erosion, *Primary productivity, Coasts, Alaska, Water pollution effects, Baseline studies, Resources development, Environmental effects, *Outer Continental Shelf, Petroleum development, Beaufort Sea.

The preliminary estimates of energy input to the nearshore marine biota shows that within approximately 10 km of shore, over 75% of the carbon is derived from the land and that this carbon is composed primarily of peat-like material that has been accumulating on land for up to 12,000 years. Thus the nearshore marine biome is apparently a 'fossil fuel' subsidized ecosystem wherein the meager annual primary production by ice algae and phytoplankton is heavily supplemented by organic carbon eroded from coastal peat bluffs and transported by river flow into the coastal zone. The implications of oil and gas development on the primary production and secondary production are mostly indirect but potentially great. Development which would increase or decrease shoreline erosion or significantly alter the rate of riverbank erosion or runoff characteristics could be expected to show corresponding impacts on the nearshore zone. (Sinha-OEIS)
W79-05920

EFFECTS OF OILING ON TEMPERATURE REGULATION IN SEA OTTERS,
La Jolla, CA. Scripps Institution of Oceanography.
G. L. Kooyman, and D. P. Costa.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. VII, Effects, p 1-11, October 1978. 11 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-7-022-35130.

Descriptors: *Mammals, *Metabolism, *Otters, *Water pollution effects, *Oil pollution, Alaska, Resources development, Baseline studies, Environmental effects, *Outer Continental Shelf, Sea otters, Temperature regulation.

The objective of this study was to measure effects of crude oil contamination on sea otters through studies on the changes in the animal's metabolic rate and subcutaneous temperatures before and after contact with oil. A second objective was to attempt to rehabilitate the otters after crude oil contamination. Crude oil contamination over small areas of the sea otter's fur causes noticeable increases in their heat loss and metabolic rate. Oiled sea otters had metabolic rates 1.4X normal. Removal of the crude oil by washing with a detergent resulted in metabolic rates that were 2.3X normal. Crude oil contamination of wild sea otters would probably cause significant thermal stress and could lead to hypothermy and/or pneumonia resulting in death. Rehabilitation of large numbers of sea otters would require sophisticated pre-existing facilities and would be extremely expensive if at all possible. (Sinha-OEIS)
W79-05921

SUBLETHAL EFFECTS OF PETROLEUM HYDROCARBONS AND TRACE METALS, INCLUDING BIOTRANSFORMATIONS, AS REFLECTED BY MORPHOLOGICAL, CHEMICAL, PHYSIOLOGICAL, PATHOLOGICAL AND BEHAVIORAL INDICES,
National Marine Fisheries Service, Seattle, WA. Northwestern and Alaska Fisheries Center.
D. C. Malins, E. H. Gruger, Jr., H. O. Hodgins, and N. Karrick.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VII, Effects, p 12-146, October 1978. 25 fig, 45 tab, 117 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Fish, *Shellfish, *Metabolism, *Pathology, *Water pollution effects, *Oil pollution,

Metals, Vertebrates, Invertebrates, Environmental effects, Resources development, Baseline studies, Alaska, *Outer Continental Shelf, *Petroleum hydrocarbons, Hydrocarbons, Sublethal effects.

Primary objectives of this research were to define and evaluate: (1) the alterations in structure of eggs, larvae, livers, and tissues of fish after petroleum exposure; (2) the importance of skin and epidermal mucus in metabolism and disposition of petroleum hydrocarbons in salmonids and flatfish; (3) the uptake, metabolism, and elimination of petroleum aromatic hydrocarbons by salmonids, demersal fish, and shrimp; (4) the effects of toxic trace metals on the metabolism of aromatic hydrocarbons by salmonids and flatfish; (5) the enzymes (aryl hydrocarbon monooxygenases) that metabolize and detoxify or activate aromatic hydrocarbons in a variety of aquatic species; (6) the physiological and embryological effects of aromatic hydrocarbons on early life forms of invertebrates; (7) the pathological effects of exposure of flatfish to crude petroleum-contaminated sediment; (8) the effects of exposures to petroleum on disease resistance of salmonids; and (9) the behavioral responses of vertebrate and invertebrate species exposed to petroleum hydrocarbons. The conclusions of this program are summarized according to disciplinary areas of study. (Sinha-OEIS)
W79-05922

EFFECTS OF PETROLEUM EXPOSURE ON THE BREEDING ECOLOGY OF THE GULF OF ALASKA HERRING GULL GROUP AND REPRODUCTIVE ECOLOGY OF LARGE GULLS IN THE NORTHEAST GULF OF ALASKA,
John Hopkins Univ., Baltimore, MD. Dept. of Pathobiology.
S. M. Patten, Jr., and L. R. Patten.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. VII, Effects, p 151-309, October 1978. 72 fig, 22 tab, 46 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Oil pollution, *Gulls, *Breeding, *Ecology, *Reproduction, Oil spills, Water pollution effects, Environmental effects, Baseline studies, Resources development, Alaska, *Outer Continental Shelf, Petroleum, Gulf of Alaska, Larus, Herring gulls.

An investigation of primary and potential secondary effects of gas and oil development on large gulls (Larus) in the northeast Gulf of Alaska is reported. Conclusions are: very small amounts of North Slope (Prudhoe Bay) Crude Oil exposure to gull eggs in the field, at early stages of incubation, lead to high embryonic mortality. Embryonic resistance to petroleum exposure increases with the duration of incubation. Mineral oil (control) in equivalent microliter doses causes no significant mortality. Gull behavior is altered by the continued incubation of eggs dead from petroleum exposure. Adult gulls fail to respond with the normal production of replacement clutches, which normally follow clutch loss to natural causes. The combination of high egg mortality and alteration of adult behavior virtually eliminates gull reproduction in the experimentally oiled area. (Sinha-OEIS)
W79-05923

INFLUENCE OF PETROLEUM ON EGG FORMATION AND EMBRYONIC DEVELOPMENT IN SEABIRDS,
Point Reyes Bird Observatory, Stinson Beach, CA.
D. G. Ainley, C. R. Grau, S. H. Morrell, T. Roudybush, and R. R. LeValley.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VII, Effects, p 310-333, October 1978. 4 fig, 4 tab, 30 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Birds, *Reproduction, *Oil pollution, *Water pollution effects, Embryos, Alaska, California, Baseline studies, Environmental effects, Resources development, *Outer Continental Shelf, Petroleum development, Larus, Ptychoramphus aleuticus, Food supply.

The effects that brief exposure to an oil spill would have on the reproduction of Cassin's Auklets (Ptychoramphus aleuticus) and on Western Gulls (Larus occidentalis) nesting on the Farallon Islands of California were studied. These species are representative of many birds breeding in Alaska and the lower Pacific Coast states that are at risk from oil pollution during the reproductive period. It is not possible to draw definitive conclusions from the results obtained during this first year of study in which auklets were dosed with small amounts of bunker C oil. However, under the conditions of the experiment, the oil did not cause any apparent adverse effects on reproduction of auklets such as those that were obtained when comparable doses were given to laboratory quail. This does not mean, however, that oil is harmless to seabirds. The experiment was designed to minimize general effects of oil and to maximize unique features of reproduction that might reveal subtle effects of oil instead of gross and multiple stresses such as those observed in massive spills. Furthermore, oil doses had to be given to the female several hours after the time of feeding, a condition that would be unlikely in the event of an inadvertent spill at a feeding area. If auklets, gulls, or murres are subjected to foods contaminated by oil, they are likely to be able to deal with this oil by rapid elimination through the gut (auklets, murres) or by regurgitation (murres, gulls), and that oil will probably not constitute a hazard, provided other, noncontaminated food becomes available in a reasonable time. (Sinha-OEIS)
W79-05924

COMPOSITION AND SOURCE IDENTIFICATION OF ORGANIC DETRITUS IN LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. D. Larrance.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VII, Effects, p 334-349, October 1978. 2 fig, 2 tab, 17 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Oil pollution, *Fisheries, Shellfish, *Water pollution effects, *Plankton, *Detritus, Benthos, Alaska, Resources development, Baseline studies, *Outer Continental Shelf, *Cook Inlet, Petroleum development, Food web.

Offshore petroleum development in lower Cook Inlet will provide a potential source of contamination of the environment by accidental large spills and chronic low-level oil pollution. Such pollution would undoubtedly have a harmful effect on important commercial fisheries in lower Cook Inlet. Benthic species harvested include snow, king, and Dungeness crab, shrimp, razor clams, and scallops. These are commercially harvested primarily within the rectangle bordered by Anchor Point, Kachemak Bay, the Barren Islands, and Kamishak Bay. Some primary king crab recruitment grounds are within this area in the Bluff Point-Kachemak Bay region. The larval stages of these and other benthic species are planktonic and rely on phytoplankton as food. Adults in the benthic community ultimately depend on organic production from phytoplankton and other plants. Phytoplankton grazed by zooplankton enters the detrital food web via fecal pellet deposition. Other cells enter the benthos by sinking directly. As small sinking particles, the cells and pellets may act to transport oil from the surface to the bottom. Studies have indicated rapid removal and dispersal of surface oil by suspended particles. When oil enters seawater, emulsions of very tiny droplets can form. Some of the droplets become bound to particles by absorption and adsorption; they subsequently sink directly or are sedimented in fecal pellets after being ingested by zooplankton. Thus, ingestion and sorption act as precipitation mechanisms to transfer otherwise buoyant oil particles to the detrital food web. (Sinha-OEIS)
W79-05925

RESEARCH TO DETERMINE THE ACCUMULATION OF ORGANIC CONSTITUENTS AND HEAVY METALS FROM PETROLEUM-IMPACTED SEDIMENTS BY MARINE DETRITIVORES OF THE ALASKAN OUTER CONTINENTAL SHELF,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
J. W. Anderson, J. M. Augenfeld, E. A. Crecelius, and R. Riley.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VII, Effects, p 350-403, October 1978. 2 fig, 12 tab, 45 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 2311102778.

Descriptors: *Sediments, *Trace elements, *Benthos, *Food chain, *Oil pollution, *Heavy metals, Alaska, Water pollution effects, Environmental effects, Resources development, Baseline studies, *Outer Continental Shelf, *Detritivores, Petroleum hydrocarbons, Hydrocarbons, Macoma inquinata, Phascolosoma agassizii, Abarenicola pacifica.

During FY1977 and 1978, experiments were conducted to examine the bioavailability of petroleum hydrocarbons and trace metals from petroleum-impacted marine sediments. The feasibility of using bivalve condition index and free amino acid pool as indicators of stress due to petroleum exposure was also tested. Prudhoe Bay crude was the test oil in all experiments. Results suggest that mode of feeding is a determinate factor in the availability of sediment-sorbed hydrocarbons to benthic animals. Short-term experiments with 14C-labeled specific aromatic hydrocarbons in the laboratory indicated that ingestion of contaminated sediment resulted in negligible uptake of 2-methylnaphthalene by Macoma inquinata. Uptake of 14C-phenanthrene, -dimethylbenzanthracene, and -benzo(a)pyrene, however, exhibited components which could be attributed to both direct uptake from sediment and uptake from seawater. Magnification factors showed that hydrocarbons were concentrated from seawater but not from sediment. Both free amino acid content and condition index of Macoma inquinata were sensitive to stress, as they showed significant reductions, compared to control animals, during field exposure to oil sediment. Compared to sediment concentrations, nickel, copper, zinc, and manganese were elevated in Phascolosoma agassizii, and nickel, zinc, and selenium in Macoma inquinate. Recent research with a mud-ingesting polychaete, Abarenicola pacifica, indicates that this species takes up and retains more phenanthrene than naphthalenes. It has been possible to detect behavioral modifications, ingestion rate reduction, and decreases in phenantrene content of sediment after passage through the gut. (Sinha-OEIS)
W79-05926

BEAUFORT SEA BARRIER ISLAND-LAGOON ECOLOGICAL PROCESS STUDIES. OVERVIEW AND SYNTHESIS,
LGL Ltd.-U.S., Inc. Bryan, TX.
J. C. Truett.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VII, Effects, p 404-406, October 1978. 4 fig, 4 tab, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35193.

Descriptors: *Coasts, *Birds, *Fish, *Invertebrates, *Water pollution effects, Alaska, Resources development, Baseline studies, *Outer Continental Shelf, *Beaufort Sea, Petroleum development, Food supply.

This study of a coastal area of the Beaufort Sea in Alaska analyzes the critical system processes (patterns of change) to provide information that can be used to assess the impacts of activities related to

petroleum development. The implications of these research findings to petroleum development in the nearshore zone include the following: Nearshore currents and water quality parameters (salinity, temperature, etc.) will probably be modified (at least locally) by major changes in the landforms that bound the system. Whether the birds and fish will ultimately be affected by such changes is not yet known. Shoreline stabilization practices that reduce the organic detritus input into nearshore waters could conceivably affect the fish and birds by reducing the availability of an important energy source. This hypothesis has yet to be tested. Introduction of contaminants (e.g., oil) into nearshore systems could directly affect birds (and perhaps fish), or could indirectly affect both birds and fish by affecting the epibenthic invertebrates--their primary food source. (Sinha-OEIS)
W79-05927

BEAUFORT SEA BARRIER ISLAND-LAGOON ECOLOGICAL PROCESS STUDIES. AVIAN ECOLOGY IN SIMPSON LAGOON, 1977,
LGL Ltd., Edmonton (Alberta).
S. R. Johnson.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VII, Effects, p 467-586, October 1978. 3 fig, 25 tab, 73 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Birds, *Habitats, *Ecology, *Environmental effects, *Resources development, Temporal distribution, Migrations, Water pollution effects, Oil pollution, Alaska, *Outer Continental Shelf, Beaufort Sea, Simpson Lagoon, Petroleum development, Ecological distribution.

The research program addresses four ecosystem uses/dependencies of birds--for migration, breeding, feeding and staging-molting. These uses are evaluated as they relate to barrier island-lagoon habitats and predicted development alterations of habitats. General conclusions were that: Bird activity was minimal while the nearshore areas remained frozen in early summer; potential impacts of development are therefore probably also low at this time except for those activities which would create open water. Nearshore area were used moderately by birds after breakup began but before the nearshore became completely ice-free. Heaviest use of nearshore areas by birds occurred during the open-water season--August and September. Primary use of the area at this time was by molting and migrating oldsquaws, staging shorebirds, and staging glaucous gulls. Feeding activity in the area was intensive by all these birds. Potential impacts of development may, therefore, be most serious during this open-water season. Industrial activity following petroleum leasing of nearshore waters may potentially affect birds in two major ways: by imposing direct mortality or stress (e.g., oiling of birds, disturbance caused by aircraft overflights, destruction of nesting habitat, or introduction of predators); and by interrupting key physical and biological processes (e.g., coastal erosion, water circulation, nutrient and invertebrate production and cycling, etc.) that currently enable birds to successfully use the area for migration, breeding, feeding, staging and/or molting, or that affect the degree of mortality or stress. (Sinha-OEIS)
W79-05928

BEAUFORT SEA BARRIER ISLAND-LAGOON ECOLOGICAL PROCESS STUDIES. ECOLOGY OF FISHES IN SIMPSON LAGOON, 1977,
LGL Ltd., Nanaimo (British Columbia).
P. C. Craig, and W. Griffiths.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VII, Effects, p 587-664, October 1978. 19 fig, 13 tab, 34 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Fish, *Ecosystems, *Coasts, *Ecology, *Habitats, Oil pollution, Alaska, Water pollution effects, Resources development, Environmental effects, Baseline studies, *Outer Continental Shelf, Beaufort Sea, Simpson Lagoon, Petroleum development, Feeding grounds.

The Simpson Lagoon fisheries program addresses the role of nearshore fishes in barrier island-lagoon ecosystem on Alaska's Beaufort Sea coast. Study objectives were to identify important biological processes and habitats of fish, and assess their vulnerability to OCS petroleum development. Simpson Lagoon and other nearshore habitats are used by fish for one overriding purpose, namely feeding on the abundant nearshore food supply. Each spring as the ice melts, anadromous and marine fishes invade nearshore waters and feed extensively on epibenthic invertebrates (organisms living on or near bottom substrates). The fish accumulate food reserves for spawning and/or overwintering requirements. Several factors influencing the numbers and distribution of fish were examined but predators, parasites and food were not considered to be limiting factors for fish inhabiting nearshore waters. It appears instead that populations of nearshore fishes, particularly the anadromous species used by man, are limited by factors operative outside the nearshore environment (e.g., overwintering areas in North Slope rivers). If this interpretation is correct, the implication is that, while nearshore habitats are essential feeding areas for fish, nearshore biological processes and habitats are less vulnerable to impacts of OCS petroleum development than other locations or stages in the life cycles of key fish species. (Sinha-OEIS)
W79-05929

BEAUFORT SEA BARRIER ISLAND-LAGOON ECOLOGICAL PROCESS STUDIES. INVERTEBRATES IN SIMPSON LAGOON, 1977,
LGL Ltd., Edmonton (Alberta).
W. Griffiths, and P. C. Craig.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. VII, p 665-757, October 1978. 10 fig, 15 tab, 44 ref, 4 append. Boulder, CO.

Descriptors: *Invertebrates, *Biomass, *Abundance, *Alaska, *Oil pollution, Baseline studies, Resources development, Water pollution effects, *Environmental effects, Temporal distribution, Spatial distribution, *Outer Continental Shelf, Beaufort Sea, Ecological distribution, Petroleum development, Simpson Lagoon.

The invertebrate investigations in the Simpson Lagoon area on the Alaskan Beaufort Sea Coast in 1977 were concentrated on those organisms identified as important food items to higher trophic levels (fish and birds). The main objectives of this year's research were to determine the seasonal and habitat distributions, abundances and biomasses of these important organisms. Diver observations showed that mysids and amphipods were the most abundant invertebrate groups in Simpson Lagoon in terms of numbers and biomass. A major potential cuase of insult related to OCS petroleum development might be contaminant (e.g., oil) introductions. In the nearshore environment, invertebrates could be affected by oil in the water column or (probably more critical to epibenthos) by oil on and in benthic substrates. Adverse impacts of oil on invertebrates might affect the fish and birds that depend on those invertebrates for food. (Sinha-OEIS)
W79-05930

5D. Waste Treatment Processes

WATER EXTRACTION FROM BLACK LIQUORS (EKSTRAKTSIYA VODY IZ RASTVOROV CHERNOGO SHCHELOKA),
L. A. Kul'skii, T. V. Knyaz'kova, and N. A. Linchkovskaya.
Khimicheskaya Tekhnologiya, No. 2, p 48-50, March/April, 1978. 2 fig, 4 ref, 2 tab.

Descriptors: *Black liquor, *Separation techniques, *Water conservation, Pulp wastes, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Solvents, Organic compounds, Triethylamine, Solvent extraction, Water pollution control, Pollution abatement, Kraft mills.

An attempt has been made to determine whether water can be efficiently extracted from kraft mill black liquor with an organic solvent (triethylamine) (TEA). Distribution coefficients were determined for mineral and organic components and water in black liquor containing 34.2 g/liter of solids and of TEA after mixing equal volumes of black liquor and TEA and allowing the two phases to separate at 5.5-20.05C. The same determinations were made for black liquors containing 4.27-34.2 g/liter of solids at 15-18C. The experimental data indicated that removing water from the black liquor was more efficient than removing mineral impurities. (Chern-IPC)
W79-05502

WATER QUALITY IMPROVEMENTS FROM UPGRADED WASTE TREATMENT,
Virginia State Water Control Board, Richmond.
K. C. Das, and J. J. Cibulka.
Journal Water Pollution Control Federation, Vol. 50, No. 10, p 2276-2288, October, 1978. 10 fig, 5 ref, 6 tab.

Descriptors: *Water quality, *James River(Virginia), Water pollution effects, Biochemical oxygen demand, Temperature, Dissolved oxygen, Coliforms, Bacteria, Virginia, Pulp wastes, Pulp and paper industry, Effluents, Wastes, Industrial wastes, Water pollution sources, Estuaries, Pulp wastes, Sewage treatment, Surface runoff, Runoff, Organic compound, Pollution abatement.

BOD, temperature, dissolved oxygen (DO), and fecal coliform concentration data, obtained in 1975, are tabulated and graphed for designated sites along the upper fresh-water tidal portion of the James River (Virginia) estuary. This portion of the river receives effluents from a paper company, two (Richmond and Chesterfield) County sewage treatment plants, and a cellophane/synthetic fibers mill. The data indicate that there is a marked improvement in the DO concentration as a result of a significant reduction in the amount of oxygen-demanding carbonaceous materials in the estuary portion of the test reach. This improvement has resulted largely from the recent advent of secondary treatment of the city's discharge and the termination of a discharge by a second paper mill. The quantity of nitrogenous BOD discharged into the river is significant and could have severe impact during extreme drought conditions. At present, approximately 3,600 kg/day (8,000 lb/day) of carbonaceous BOD is discharged in waste waters, compared to ca. 10,000 kg/day (22,000 lb/day) of nitrogenous BOD. The reduction of fecal coliform organisms in the river reach can be attributed in part to improvements in overall waste water treatment, including chlorination. Deoxygenation rate constants have been altered in the reach under consideration. The introduction of secondary treatment at the city's waste water treatment plant, treatment upgrading by one paper company, and elimination of discharges by a second paper company may all contribute to this alteration. BOD loading increased with freshwater inflow to the estuary, possibly because of organics entering the river with runoff. (Swichtenberg-IPC)
W79-05503

FOLLUM (FABRIKKER A/S., NORWAY) HAS FULFILLED ANTIPOLLUTION DEMANDS (FOLLUM HAR OPPFYLT UTSLIPPSKRAVENE),
K. J. Gurandsrud.
Norsk Skogindustri, Vol. 32, No. 10, p 224-225, October, 1978. 3 fig.

Descriptors: *Pulp wastes, *Waste water treatment, *Treatment facilities, Equipment, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Foreign countries, Sludge, Filters, Water consumption(Except consumptive use), Sedimentation, Norway, Europe.

The Follum pulp mill's effluent-treating and pollution-control installation centers around a circular sedimentation basin (38 m diameter, 4.5 m deep, ca. 5000 cu m volume) which can clean ca. 15 cu m effluent/min. Sedimented sludge is concentrated from 2% to 20-25% consistency in an Eimcobelt vacuum filter. Since startup of the installation, freshwater consumption at the mill has been halved. (Brown-IPC)
W79-05504

COMBINED EFFLUENTS FROM THREE MILLS ARE HANDLED BY SINGLE NEW FACILITY,
Consolidated Papers Inc., Wisconsin Rapids, WI.
S. Martin.
Pulp and Paper, Vol. 52, No. 11, p 186-187, October, 1978. 1 illus.

Descriptors: *Pulp wastes, *Waste water treatment, Wisconsin River(Wisconsin), Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Waste treatment, Pulp and paper industry, Effluents, Wisconsin, Biological treatment, Pipelines, Suspended solids, Biochemical oxygen demand, Sludge treatment, Dewatering, Sludge, Landfills, Outlets, Clarifiers, Coated paper, Fiberglass, Kraft mills, Pollution abatement.

Effluent from the Kraft Division (bleached kraft pulp mill), Wisconsin Rapids Division, and Biron Division (both coated paper mills) of Consolidated Papers Inc. is pumped via a system of six miles of reinforced fiberglass pipe to the water quality center for primary and secondary treatment. The treatment system consists of lift-pumping stations at each of the three divisions, a primary treatment stage to reduce suspended solids, a biological treatment stage to reduce the quantity of BOD, secondary clarifiers to remove solids, sludge dewatering presses, a landfill, and a submerged outfall to the Wisconsin River. Typical BOD loadings to the lagoons have been 54,477 lb/day, whereas effluent discharges contain only 3,434 lb/day. (Swichtenberg-IPC)
W79-05507

MEMBRANE PROCESSES FOR ENVIRONMENTAL STUDIES,
D. Freilich.
Swedish Water and Air Pollution Research Institute, Technical Report No B 481, January 1979. 31 p, 3 fig, 3 tab, 15 ref.

Descriptors: *Membrane processes, *Waste water treatment, *Indutrial wastes, *Pulp and paper industry, *Textiles, *Water pollution control, *Filtration, Reverse osmosis, Hyperfiltration, Ultrafiltration, Pollutants, Costs, Capital costs, Operating costs, Costs, Economic feasibility, Effluents, Dynamic membranes, Membranes, Equipment.

As part of a project on the use of dynamic membranes for wastewater treatment, different classes of membranes are briefly surveyed with emphasis on dynamic membranes, and treatment of industrial wastewaters by membrane processes in the pulp and paper and textile industries is reviewed. Most applications are concerned with concentration of effluents, but processes can be made economically feasible through reuse of chemicals. Removal of dissolved low-molecular-weight solutes by filtering them from water under pressure through membranes (reverse osmosis or hyperfiltration) can be considered an extension of ultrafiltration, in which particles of colloidal dimensions are filtered from disperse systems. In the highly specific membrane process it is best to use decentralized feeds with one or few pollutants, whereas in conventional treatment centralized feeds can be used. Membrane separation processes are useful in the pulp and paper, textile, food, metal washing and electroplating, and electrochemical and chemical industries. Advantages of dynamic membranes: (1) high water fluxes, (2) generation and regeneration in-situ, (3) use with high temperature and corrosive feeds, and (4) relatively low capital and operation costs. Dynamic membranes are a relatively new type, related to composite membranes. Thin layers of neutral or ion-exchange materials are formed in the pores on the surface of finely porous substrates by filtering pressurized solutions of additive. (Lynch-Wisconsin)
W79-05735

CHEMISTRY OF NITRIFICATION-DENITRIFICATION PROCESS,
Stevens Inst. of Tech., Hoboken, NJ. Dept. of Mechanical Engineering.
L. K. Wang, C. P. C. Poon, M. H. Wang, and J. Bergenthal.
The Journal of Environmental Sciences, Vol. 21, No. 6, p 23-28, November-December 1978. 21 ref.

Descriptors: *Chemistry, *Nitrification, *Denitrification, *Activated sludge, *Respiration, *Equations, *Sewage treatment, Nitrogen, Stoichiometry, Nitrogenous oxygen demand, Water pollution sources, Treatment facilities, Nitrates, Nitrites, Ammonia, Carbon, Bacteria, Alkalinity.

General stoichiometric equations are given for nitrification-denitrification reaction, chemistry, and respiration; the significance of nitrification and denitrification phenomena in activated sludge sewage treatment processes and in receiving waters is also discussed; current important design criteria for the nitrification-denitrification process are reviewed. New stoichiometric nitrification equations are presented in which alkalinity, in terms of HCO3(-), is included as an important parameter. The equations not only predict the same stoichiometric oxygen requirements which have been reported earlier, but further predict the amount of alkalinity needed in process water to maintain nitrification. Neutralization reactions in the nitrification process are also proposed which predict that one mole calcium bicarbonate is needed to neutralize every two moles nitric acid produced. Stoichiometric denitrification equations are presented which consider C sub-a--H sub-b--0 sub-c to be the general molecular formula of the carbon source to be utilized in a biological denitrification process. The general stoichiometric respiration equations assume C sub-a --H sub-b --0 sub-c --N sub-d --P sub-e --S sub-f to be the organic matter to be biologically oxydized. Since 1970 the importance of nitrification has again been recognized, as U.S. engineers now consider both BOD and NOD (nitrogenous oxygen demand) as potential loads of stream pollution. (Lynch-Wisconsin)
W79-05737

SOLIDS CONTROL IN EFFLUENTS FROM AERATED LAGOON SYSTEMS,
Clemson Univ., SC. Water Resources Research Inst.
L. G. Rich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 542, Price codes: A06 in paper copy, A01 in microfiche. Report No 73, 1978. 105 p, 28 fig, 21 tab, 34 ref, 2 append. OWRT B-105-SC(1).

Descriptors: *Lagoons, Aerated lagoons, *Suspended solids, Wastewater treatment, Municipal wastewater, Biochemical oxygen demand, South Carolina.

In South Carolina, as well as in other states in the Southeast, wide use has been made of aerated lagoon systems to treat municipal wastewater discharges of less than one million gallons per day. These systems fall in the category of low-cost, low-energy, and low-maintenance treatment technology which is ideal for such application. Unfortunately, however, the performance of existing aerated lagoon systems fails to meet the requirements of the 1977 effluent standards on a consistent basis. The failure centers primarily on the suspended solids discharged from the lagoon and the biochemical oxygen demand exerted by the solids. This report describes (1) a field investigation to provide a more definitive knowledge of the performance of existing aerated lagoon systems serving municipalities in the Piedmont region of South Carolina, (2) a laboratory investigation to obtain a better understanding of the settling characteristics of bacterial biomass solids in suspensions with concentrations similar to those encountered in aerated lagoon effluents, and (3) an engineering study to develop criteria for the design of aerated lagoon systems capable of improved performance with respect to effluent suspended solids. The engineering study involved the analysis of data obtained from the field and laboratory investigations, as well as information derived from the literature.
W79-05828

ADSORPTION OF VIRUS ON ACTIVATED CARBON UNDER VARYING WATER CHEMISTRY CONDITIONS,
Maryland Univ., College Park. Water Resources Research Center.
R. P. Healy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 530, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 52(2), (1975), 64 p, 21 fig, 6 tab, 22 ref. OWRT A-023, MD(1). 14-31-0001-5020.

Descriptors: *Viruses, *Activated carbon, *Sewage effluent, Virus adsorption, Mathematical models.

The purpose is to investigate the adsorption of virus on activated carbon from waters of different solution chemistry such that design parameters for carbon columns can be determined. Column tests are conducted with viruses suspended in chemically known buffer solution, tap water, and secondary sewage effluent. Adsorption of virus from the buffer solution and the secondary effluent obeys Langmuir and Freundlich isotherms. For a virus concentration of 10 to the fifth power-10 to the sixth power PFU/ml in the buffer solution, the carbon monolayer capacity is 3.39 x 10 to the fifth power PFU/mg and the equilibrium constant is 9.97x10 to the -seventh power ml/PFU. In secondary effluent this same virus concentration gave a carbon capacity of 1.28x10 to the fifth power PFU/mg and an equilibrium constant of 6.27x10 to the minus fifth power ml/PFU. at a reduced virus concentration of 1000 - 10,000 PFU/ml, in secondary effluent, the carbon capacity if 2.54x1000 PFU/mg and the equilibrium constant is 3.52x10 to the minus fourth power ml/PFU. Thus, the carbon capacity varies with the virus concentration in solution when suspended in secondary sewage effluent. Organics in secondary effluent may compete with the virus for the available adsorption sites on the carbon. The adsorption on carbon was reduced in secondary effluent as compared with the buffer solution. A virus concentration of 10 to the fifth power-10 to the sixth power PFU/ml in tap water did not represent adsorption condition in this study. This appears to be due to the dispersion of virus agglomerates that were present in the virus preparation. The competition of effluent organics and virus for adsorption sites causes the experimental virus concentration displacement curves to be different than the theoretical curve as expressed by the mathematical model tested in this study. The column breakthrough curves illustrate that a steady condition with regard to the development of a virus concentration profile does not readily occur.
W79-05831

TECHNOLOGY AND ECONOMICS OF INDUSTRIAL POLLUTION ABATEMENT,
Illinois Inst. for Environmental Quality, Chicago
For primary bibliographic entry see Field 5B.
W79-05865

REMOVAL OF COLOR, DETERGENTS, AND OTHER REFRACTORY SUBSTANCES FROM TEXTILE WASTEWATER,
Institute of Meteorology and Water Management, Kracow (Poland).
J. Kurbiel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 24 Price codes: A21 in paper copy, A01 in microfich Report No. EPA-600/2-78-072, March 1978. 488 135 fig, 125 tab, 81 ref, 3 append. PR-5-532-

Descriptors: *Waste water treatment, *Tertiary treatment, *Industrial wastes, *Textiles, *Municipal wastes, Waste water, Biological treatment, Activated sludge, Water pollution treatment, Filtration, Coagulation, Adsorption, Oxidation, Ion exchange, Reverse osmosis, Activated carbon, Pollutants, Water purification, Separation techniques, Economic feasibility.

Laboratory and pilot sale research was carried out to determine the effectiveness and economic feasibility of selected physicochemical treatment processes for removing color, detergents and other refractory pollutants from mixed textile and municipal waste water previously treated with activated sludge. The following tertiary processes were studied individually and in combined systems; filtration on single and dual media filters, conventional and contact coagulation, adsorption on granular activated carbon, oxidation with ozone, ion exchange on anionic and cationic resins, and hyperfiltration (reverse omsosis). Although the results indicate that the treatments effectively removed the individual pollutants, the feasibility of the processes determined by economic factors, energy consumption, and technical availability differs. The hyperfiltration process was the most energy intensive. Ion exchange revealed poor COD removal and a great amount of post-regeneration waste water. The most effective combined treatment was contact coagulation on upflow filters and dual media filtration which was preceded by chlorination with NaOCl and followed by absorption on activated carbon. (Davison-IPA)
W79-05867

WATER TREATMENT,
Laporte Industries Ltd., London (England). (Assignee).
W. H. Redmayne, and D. Berry.
U.S. Patent No. 4,131,545, 3 p, 2 ref; Official Gazette of the United States Patent Office, Vol. 977, No 4. p 1220, December 26, 1978.

Descriptors: *Patents, *Water treatment, *Waste water treatment, *Water pollution treatment, Water purification, Water quality control, Chemicals, Inorganic chemicals, Phosphates, Potable water, Aluminum.

Phosphate containing basic aluminum solutions are provided by reaction aluminum sulphate solution with phosphoric acid, adding chloride, basifying by precipitation of calcium sulphate from solution and cooling the resultant solution in a controlled manner. Preferably addition of chloride and basification occurs at a temperature of 80-90C and the solution is cooled to below 60C soon after the basifying salts have been introduced. The solutions, preferably diluted to an aluminum content of 1 to 2% Al2O3 are useful for clarifying water and dewatering sewage sludge. Potable water which has been treated in this way is often stored in reservoirs and water extracted from sludges is recycled through the sewage treatment plant, the outflow from which is usually discharged into nearby rivers or canals. It would be expected that any treatment of water which included phosphate could lead to eutrophication problems. However, it has been found that in general the phosphate is retained in flocs formed during the water treatment, and is thus not released to any substantial extent into the water supplies. In fact treatment with basic aluminum solutions according to the invention tends to lead in general to the lowering of phosphate levels in the water treated. (Sinha-OEIS)
W79-05948

SEWAGE OSMOSIS SYSTEM,
Sewage Osmosis Ince., Minneapolis, MN. (Assignee).
E. C. Peterson, and F. P. Coolbroth.
U.S. Patent No 4,132,625, 6 p, 2 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 978, No 1, p 230, January 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Waste water disposal, *Soil disposal fields, Anodes, Cathodes, Electric fields, Rocks, Dolomite, Carbon, Absorption, Coke.

A system is described for dispersing aqueous effluents from a sewage treatment system utilizing a generally closed septic or sewage retention tank and a subterranean disposal field area for receiving the discharge from the septic tank. The septic tank is arranged to receive raw sewage and to retain solids and ultimately discharge aqueous fluid effluent into the disposal field area which is placed next to the septic tank vessel. Anode means and cathode means are arranged generally laterally of the disposal field with the anodes and cathodes being disposed on opposite sides of the disposal field. The anodes consist essentially of independent cells of crushed raw rock dolomite, hard limestone, or basalt, each of which is a naturally-occurring mineral. An additive of fused dolomite powder is preferably added to each of the anodes, in a suitable quantity as required. The cathodes consist essentially of a material high in carbon content, preferably coke screenings. The anodes and cathodes combine to establish an electrical field across the disposal field, and assist in dispersing the effluent into the soil and ground. (Sinha-OEIS)
W79-05950

METHOD AND APPARATUS FOR REMOVING FILTERABLE SUBSTANCES FROM A LIQUID,
Ifo Sanitar A. B., Bromolia (Sweden). (Assignee).
K. A. G. Olsson, K. P. E. Astrom, and J. C. Johansson.
U.S. Patent No. 4,131,546, 7 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 4, p 1221, December 26, 1978.

Descriptors: *Patents, *Waste water treatment, *Filtration, *Separation techniques, *Water pollution treatment, Pulp and paper industry, Domestic wastes, Eqluipment.

Small particles which occur in digested sludge or sludge formed in a wet aerobic digestion process for sanitary treatment of domestic waste in water, or fibers (including very fine fibers, so-called micro-fibers) in water from the pulp and paper industries can be separated by means of a specially arranged filter which has a very large total surface and may be removed in a unique way as it is used. The water is caused to pass radially through a cylindrical roll of web-formed wet-strength fiber material. By drawing out the fiber web at only low speed from the innermost turn of the roll through the central cavity of the roll, the effect is achieved that the roll continuously exposes a relatively clean filtering surface to the liquid. When the fiber web with the substances collected from the liquid is drawn out from the central cavity of the fiber web roll, the web is for natural reasons twisted to form a spiral. The twisting movement of the fiber web is utilized to form as it moves further away from the roll, a steadily tighter spiral for enclosing and 'packaging' the substances normally being solids but may also be fats and oils or other fluid or semi-fluid. The fiber web roll may be placed in a container or may be air-dried or may be disintegrated before being disposed of. (Sinha-OEIS)
W79-05955

REMOVING COAGULABLE SUBSTANCES FROM AN AQUEOUS MEDIUM,
Wafilin B.V., Swolle (Netherlands). (Assignee).
W. J. de Putter.
U.S. Patent No 4,131,541, 5 p, 1 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 977, No 4, p 1219, December 26, 1978.

Descriptors: *Patents, *Waste water treatment, *Food processing industry, *Proteins, *Separation techniques, *Water pollution treatment, Organic compounds, Organic wastes, Odor, Filtration, Membrane processes, Water reuse.

Proteins from potato fruit waste water produced in processing potatoes for the production of potato starch give rise to fermentation symptoms when the water is discharged to surface water and to development of a disagreeable smell. A very simple method for removing these proteins from waste water is a heating treatment, after which the coagulable proteins precipitate and can be filtered off. This invention provides a method so that any risk of fermentation or other microbiological processes is excluded or at least decreased. This is achieved by the arrangement that the aqueous medium prior to heating is subjected to an ultra filtration with a pressure ranging from 5 to 15 Atm. and in that the protein concentration is increased preferably to a value of at least 4%. In such membrane filtrations the aqueous medium is passed along a membrane which is permeable for water but not for proteins and other high molecular substances, which causes a concentration of proteins and other substances in the discharged medium, while permeate in the form of pure water or water containing low molecular weight substances as a permeate is obtained. This pure water or aqueous solution can again be used in the process of producing potato starch from potatoes. (Sinha-OEIS)
W79-05956

PROCESS AND APPARATUS FOR REMOVAL OF CONTAMINANTS FROM WATER,
Westinghouse Electric Corp., Pittsburgh, PA. (Assignee).
K. Moeglich.
U.S. Patent No 4,131,526, 11 p, 4 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 977, No 4, p 1215, December 26, 1978.

Descriptors: *Patents, *Water treatment, *Waste water treatment, *Water purification, Industrial wastes, Electrolysis, Alternating current, Catalysts, Separation techniques, Equipment.

For the purification of water supplies and for the treatment of waste waters, such as the discharges from manufacturing processes, sewage disposal plants and chemical operations, it is desirable to remove material which would otherwise be objectionable in it such as poisonous and malodorous chemicals, such as cyanides and phenolics. Other materials which are oxidizable in the waters into which the effluents are discharged, thereby creating an oxygen demand, should also be removed. A process for the removal of oxidizable contaminants from an aqueous medium comprises applying an alternating current of a frequency of 0.5 to 800 Hz to a pair of electrodes in contact with the contaminated aqueous medium, with catalyst-containing particles in the medium between the electrodes. The catalyst is an oxidation catalyst selected from the group consisting of a metal oxide of any of Groups IVa, Va, VIb and VIIB, and mixtures thereof. In preferred embodiments of the invention the catalyst-containing particles are particles in a bed which are coated with a suitable oxide such as one of manganese, chromium, bismuth or lead and they may be mixed with particles of activated carbon and/or graphite. The alternating current is at a frequency of 10 to 400 Hz, certain particle sizes of the bed packing are employed, the electrodes are of particularly described materials and preferred voltages, current densities, temperatures and pH's are utilized. (Sinha-OEIS)
W79-05957

SEWAGE TREATING AND CONVERSION PROCESS,
Nuclear Supreme, Casper, WY. (Assignee).
O. R. Waltrip.
U.S. Patent No 4,130,483, 5 p, 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 977, No 3, p 866-867, December 19, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Filtration, Gases, Electric fields, Water reuse, Coals, Coke, High sulphur coal.

A high sulphur content coal is ground into particles and undergoes a coking operation in the presence of steam to form a particulate coke product and a gaseous product including sulphur dioxide and steam. The particulate coke is charged into two settling tanks to form filter beds. The aqueous sewage to be treated is introduced into one of the

settling tanks for passage through the filter bed where it reacts with the particulate coke both physically and chemically. A liquid effluent is withdrawn from the bottom of the settling tank while a settled solid product is periodically removed to deplete the filter bed requiring periodic recharging of the settling tank. The liquid effluent is conducted into the second settling tank for passage through the filter bed. The gaseous product from the coking operation is passed through a condenser and the condensate conducted to the second settling tank. An electric field is established in the second settling tank in order to electrically charge the particulate coke bed. As a result of the foregoing conditions within the second filter tank, the filter bed is operative to remove from the liquid effluent nitrates, phosphates and other such pollutants as well as bacterial contaminants. A liquid product in the form of potable water is extracted from the bottom of the second settling tank, suitable for irrigation purposes. (Sinha-OEIS)
W79-05962

WASTEWATER TREATMENT,
Autotrol Corp., Milwaukee, WI. (Assignee).
W. N. Torpey.
U.S. Patent No. 4,130,482, 7 p, 4 fig, 1 tab, 2 ref; Official Gazette of the United States Patent Office, Vol 977, No 3, p 866, December 19, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Water purification, Oxygen, Biochemical oxygen demand, Equipment.

A method for the treatment of wastewater utilizes partially submerged rotatable biological contactors to effect the removal of an optimum amount of carbonaceous matter per unit area of surface provided in the form of biological contactors. An oxygen enriched gaseous atmosphere is provided above the wastewater in the treatment unit and the unit is supplied at a filtrate BOD5 loading rate within a specific range. The wastewater treatment system includes at least two and preferably three or four stages in series. Each stage includes a well or trough through which a single rotatable shaft extends in a direction generally transverse to the direction of wastewater flow through the well. Each rotatable shaft supports a number of contactors, spaced along its length. (Sinha-OEIS)
W79-05963

5E. Ultimate Disposal Of Wastes

TOUGH ENVIRONMENTAL REQUIREMENTS DEMAND NEW APPROACHES TO LANDFILL,
Residuals Management Technology Inc., Madison, WI.
J. J. Reinhardt, and D. F. Kolberg.
Pulp and Paper, Vol. 52, No. 11, p 128-133, October, 1978, 5 fig, 8 ref, 3 tab.

Descriptors: *Pulp wastes, *Landfills, *Waste disposal, Pulp and paper industry, Wastes, Solid wastes, Bark, Fly ash, Municipal wastes, Wood wastes, Disposal, Ultimate disposal, Leachate, Odor, Leaching, Wisconsin, Clays, Sands, Dikes, Design, Surface waters, Groundwater, Water quality control, Wetlands, Flood plains, Geologic formations, Water pollution sources, Water pollution control.

Leachate chemical analyses at landfill sites are tabulated for a primary sludge from a rag pulp mill, for secondary and combined primary/secondary sludges from a joint waste water treatment plant and from a semichemical pulp mill, for a deinking sludge, and for a pretreatment sludge from a paper-coating operation. The data illustrates the wide variability among pulp and paper mill sludges. Codisposal of sludge with other wastes (e.g., bark, fly ash, wood fines, or municipal refuse) introduces problems, such as windblown fly ash, odors from bark, and increased leachate generation. The design concepts of new landfill facilities in Wisconsin, e.g., sites with clay cutoff walls and interior leachate collection systems, sludge-lined sites, natural clay or sand sites, and diked ponds, protect ground and surface water quality, prevent the destruction or loss of wetland and/or floodplain areas, and are compatible with both waste characteristics and the geological site settings. (Swichtenberg-IPC)
W79-05505

SLUDGE-DEWATERING TECHNIQUES MUST MEET POLLUTION CONTROL REQUIREMENTS,
Jordan Co. Inc., Portland, ME.
J. S. Atwell.
Pulp and Paper, Vol. 52, No. 11, p 180-182, October, 1978. 6 fig.

Descriptors: *Pulp and paper industry, *Sludge treatment, *Dewatering, Waste treatment, Water pollution sources, Wastes, Solid waste, Water pollution control, Filters, Pulp wastes, Centrifugation, Sludge, Environmental effects, Land, Disposal, Economics, Incineration.

During the 1960s and 1970s, the pulp and paper industry made impressive strides in the development of waste management systems to improve water quality. A direct result of the operation of this treatment has been the generation of large quantities of effluent solids (sludge). Alternative sludge-dewatering systems are described, including the vacuum filter, centrifuge, horizontal-belt filter, and filter press. It is generally necessary to evaluate sludge-dewatering alternatives for each case separately, but dewatering beyond 20% is becoming more common. Increased dewatering becomes more attractive when consideration is given to environmental problems related to land disposal and the improved economic benefits of an incineration system. (Swichtenberg-IPC)
W79-05506

EVALUATION OF PROPOSED TG AND E (TUCSON GAS AND ELECTRIC COMPANY) WASTEWATER DISCHARGE ON GROUNDWATER IN THE TUCSON BASIN,
Ground-Water Quality Consultant, Fresno, CA.
K. D. Schmidt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 058, Price codes: A04 in paper copy, A01 in microfiche. November 30, 1977. 73 p, 2 fig, 10 tab, 15 ref.

Descriptors: *Arizona, *Cooling towers, *Waste water disposal, *Powerplants, Groundwater, Water pollution, Infiltration, Groundwater recharge, Fluorides, Dissolved solids, Salinity, Sulfates, Hardness(Water), Wells, Pumping, Underground waste disposal, *Environmental impact, *Tucson(AZ), *Santa Cruz River, *Tucson Gas & Electric(AZ), Cooling tower blowdown wastewater.

The purpose of this investigation was to evaluate the probable impact of a proposed discharge of cooling tower blowdown wastewater on groundwater in the Tucson Basin. The source of the wastewater is the Tucson Gas and Electric Company. About 740,000 gallons per day of wastewater are proposed to be discharged into an unnamed arroyo which eventually flows into the Santa Cruz River. Groundwater near the proposed discharge site is used primarily for industrial (cooling water) and domestic purposes. The chemical quality of groundwater in the potentially impacted area is excellent for domestic, industrial, and irrigation use except for high hardness and occasionally high fluoride contents. The impact of the proposed discharge on groundwater quality is highly dependent on the infiltration rate of wastewater in both Julian Wash and the Santa Cruz River. The discharge of 742,000 gallons per day of such wastewater at a total dissolved solids content of 500 mg/l would have little or no measurable impact on groundwater quality in the Tucson Basin. A discharge of wastewater with 1000 mg/l TDS could have some impact, while wastewater with 2500 mg/l TDS could have a significant impact on the quality of water pumped from some wells. (Visocky-ISWS)
W79-05519

DISPOSAL OF SALINE WATER CONVERSION BRINES -- AN ORIENTATION STUDY,
Louis Koenig - Research, San Antonio, TX.
For primary bibliographic entry see Field 3A.
W79-05657

SEWAGE OSMOSIS SYSTEM,
Sewage Osmosis Ince., Minneapolis, MN. (Assignee).
For primary bibliographic entry see Field 5D.
W79-05950

5F. Water Treatment and Quality Alteration

WATER QUALITY IMPROVEMENTS FROM UPGRADED WASTE TREATMENT,
Virginia State Water Control Board, Richmond.
For primary bibliographic entry see Field 5D.
W79-05503

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS, PART I. SUMMARY,
Battelle Pacific Northwest Lab., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-05728

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS. PART 2, MODEL FORMULATION, CALIBRATION AND VERIFICATION,
Battelle Pacific Northwest Lab., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-05729

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS. PART 3, USER'S MANUAL,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-05730

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS. PART 4, MT. BOLD RESERVOIR DATA AQUISITION AND EVALUATION,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-05731

INFLUENCE OF NON-POINT POLLUTION SOURCES IN CONNECTION WITH THE TUY RIVER BASIN SANITATION STUDIES,
Universidad Central de Venezuela, Caracas.
For primary bibliographic entry see Field 5A.
W79-05740

PROCESS FOR PROTECTING ASBESTOS-CEMENT BEARING SURFACES IN RECIRCULATING COOLING WATER SYSTEMS,
Betz Labs., Inc., Trevose, PA. (Assignee).
For primary bibliographic entry see Field 8F.
W79-05949

PROCESS AND APPARATUS FOR REMOVAL OF CONTAMINANTS FROM WATER,
Westinghouse Electric Corp., Pittsburgh, PA. (Assignee).
For primary bibliographic entry see Field 5D.
W79-05957

5G. Water Quality Control

LAND AND WATER USE IN SAUDI ARABIA
Technische Univ., Brunswick (Germany, F.R.).
Z. Hussain.
World Crops, Vol. 30, No. 2, p 58-61, March/April, 1978. 8 fig, 6 ref.

Descriptors: *Drainage engineering, *Irrigation water, *Saline water, *Saudi Arabia, *Surface drainage, *Water management(Applied), Comprehensive planning, Optimum development plans, Cultivated lands, Crop production, Impoundments.

Because of the loss of one-third of the arable land in the great Al-Hassa oasis in eastern Saudi Arabia due to increasing soil salinity, the Al-Hassa Irrigation and Drainage Authority (HIDA) was created in the late 1960s to oversee construction of drainage ditches and concrete-lined irrigation canals to route the water from 32 springs (of a total of 162) into a single irrigation system. Storage of saline runoff is provided in evaporation lakes. The project is being monitored to determine reclamation results so that additional springs may eventually be brought into the system when water rights have been settled. To maximize the use of water for suitable crops is a main objective of research undertaken, at the site, for soil and water analysis and re-use of drainage water where water, soil salinity, and crop type permit. Efforts are also being made to provide better management practices through extension services to farmers, since many of the present problems that reduced the arable acreage originally are due to over-irrigation and general mis-management. In addition to limited water supplies, water quality for agricultural use is poor except for selected crops. Nevertheless, the Government's view is that the area's potential is very good under proper management. (Paylore-Arizona)
W79-05561

STORM WATER MANAGEMENT FOR LITTLE LEHIGH AND CEDAR CREEK DRAINAGE BASINS,
Lehigh Univ., Bethlehem, PA.
For primary bibliographic entry see Field 4A.
W79-05721

ACCOMPLISHMENT PLAN, REGION VIII. RED RIVER OF THE NORTH BASIN.
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 283, Price codes: A02 in paper copy, A01 in microfiche. Report March 1972. 23 p, append.

Descriptors: *Water quality, *Waste water, *Industrial wastes, *Water pollution, *Red River of the North Basin(MN), Nutrients, Dissolved oxygen, Biochemical oxygen demand, Total suspended solids, Regional planning, North Dakota, Minnesota.

The Red River of the North Basin has been selected by EPA Region VIII as a high priority area for a pollution prevention abatement and control program for fiscal years 1972, 1973, and 1974. Recreational use of the River has been limited because of municipal, industrial and agricultural discharges. This accomplishment plan discusses specific tasks and plans for accomplishing the water quality objectives for the area, including: improvement of the bacteriological and dissolved oxygen quality of the Red River; reduction of wastewater flows and concentrations through implementation of the permit program; analysis of nutrient problem and development of a control program; mitigation or prevention of adverse effects on water quality from diversion and use of Garrison project waters; and supplementation of comprehensive, basin-wide water quality management plans for the Red River Basin. For each of these tasks, the report describes the purpose of the objective, its situation, the approach used by planners, milestones in attaining the objective, interrelationships with other objectives and programs, and the unresolved policy issues and problems of the objectives. Also included are charts listing the milestones and date on which these were achieved for each objective. (Coan-NC)
W79-05722

URBAN STORMWATER MANAGEMENT AND TECHNOLOGY: UPDATE AND USER'S GUIDE,
Metcalf and Eddy, Inc., Palo Alto, CA.
J. A. Lager, W. G. Smith, W. G. Lynard, R. M. Finn, and E. J. Finnemore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 654, Price codes: A15 in paper copy, A01 in microfiche. Report EPA-600/8-77-014, September 1977. 312 p, 61 fig, 124 tab, 248 ref.

Descriptors: *Runoff, *Urban runoff, *Storm water, *Storm drains, *Waste treatment, *Combined sewers, *Water quality, *Storm sewers, *Mathematical models, *Wastewater, *Urban stormwater management, *Water quality management(Applied), *Best Management Practices(BMP), Water pollution, Sewage, Cost analysis, Water pollution effects, Planning, Drainage, Pollution abatement, Drainage systems.

The original study assessed the state-of-the-art in ongoing urban stormwater projects. This report's purpose is to improve and accelerate the transfer of new urban stormwater technology into the field. The study consists of five parts: the approach methodology, which details the planning tools available in urban stormwater management, Data Base and Normalization, which updates field approaches now being used; Best Management Practices (BMP) for Nonstructural Stormwater Control, which summarizes the cost effectiveness finding of available nonstructural measures; Unit Processes, which updates usable processes in the various unit portions of an urban stormwater system; and System Applications, which encourages use of the total systems approach to dealing with and refining urban stormwater systems. General conclusions are that there is greater need for quantification of runoff from various pollution sources in all five of these areas. Recommendations call for targeting more research and development funds to beneficial reuse programs, researching renovated river systems, study of potential benefits of sludge by-products of stormwater treatment, studying feasibility of pretreating and storing runoff for subsequent reuse in system flushing, more consideration of the role of wetlands and streams as self purifiers of stormwater pollutants, a regional/national data storage system for stormwater management programs, and more frequent reporting of data from funded demonstration projects. (See also W75-07692) (Arnold-NC)
W79-05725

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS, PART I. SUMMARY,
Battelle Pacific Northwest Lab., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-05728

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS. PART 2. MODEL FORMULATION, CALIBRATION AND VERIFICATION,
Battelle Pacific Northwest Lab., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-05729

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS. PART 3. USER'S MANUAL,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-05730

WATER QUALITY MODELS FOR MUNICIPAL WATER SUPPLY RESERVOIRS. PART 4. MT. BOLD RESERVOIR DATA AQUISITION AND EVALUATION,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-05731

A PHOSPHORUS BUDGET FOR LAKE BURLEY GRIFFIN AND MANAGEMENT IMPLICATIONS FOR URBAN LAKES,
For primary bibliographic entry see Field 5C.
W79-05734

NONPOINT SOURCE CONTROL GUIDANCE, AGRICULTURAL ACTIVITIES,
Environmental Protection Agency, Washington, DC. Water Planning Div.
R. E. Thronson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 845, Price codes: A07 in paper copy, A01 in microfiche. EPA-440/3-78-001, February, 1978. 147 p, 40 fig, 8 tab, 101 ref, 3 append.

Descriptors: Water pollution, Water pollution control, Water quality, Water quality control, Water pollution sources, Sediment discharge, Agricultural chemicals, Salinity, Grazing, Waste disposal.

This publication presents technical and management guidance information regarding problem identification and assessment, information needs and analyses, and best management practices (BMP's) to provide state and areawide water quality management agencies and other concerned groups with assistance in the development and implementation of programs to control nonpoint sources of pollution. (Skogerboe-Colorado State)
W79-05811

DISPOSAL OF A LARGE QUANTITY OF SODIUM FLUOROACETATE IN A SANITARY LANDFILL SITE LOCATED IN AN AQUIFER RECHARGING AREA,
Jefferson County Health Department, Lakewood, CO.; and Colorado Univ., Denver. School of Medicine.
C. J. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as HRP-0007056, Price codes: A02 in paper copy, A01 in microfiche. Report HRP-0007056, November 1975. 6 p, 8 ref.

Descriptors: *Landfills, *Toxins, *Groundwater recharge, *Colorado, Waste disposal, Hazards, Poisons, Land use, Geology, Natural recharge, Leaching, Public health, Water wells, Water quality, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Sodium fluoroacetate.

This report was a case history illustrating the need for suitable precaution in handling large amounts of very toxic and hazardous materials. The safe disposal of very large amounts of hazardous substances presents special problems. In this case, no one involved realized that a potentially serious situation was being created inadvertently. It is very probable that similar situations are occurring elsewhere without notice. On November 6, 1974, the author was informed that 6,000 pounds of material described as 'ineffective rat bait' had been buried at a sanitary landfill site. The bait was considered ineffective because the grain had become too old to be palatable to rats. The agent in the bait, 1080 or Sodium Monofluoracetate (MFA), was thought to be as fully potent as when manufactured. The sanitary landfill did not appear to be the proper site for disposal of such a large amount of such a highly toxic and soluble toxin. A check of drainage maps of the area disclosed that an intermittent stream ran by the disposal site and within a mile downstream there were 8 homes on wells near the stream. The stream continued then for some distance, draining into a reservoir for a large water district. The material was removed and arrangements were made for storage. Subsequent meetings with State officials resulted in the decision that the material should be encapsulated before burial. This incident illustrates the need for better guidelines concerning the disposal of hazardous substances. (Sims-ISWS)
W79-05835

WATER TREATMENT,
Laporte Industries Ltd., London (England). (Assignee).

For primary bibliographic entry see Field 5D.
W79-05948

APPARATUS FOR REMOVING RAINBOWS FROM FLOWING WATER,
G. A. Black.
U.S. Patent No. 4,130,489, 5 p, 8 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 3, p 868-869, December 19, 1978.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, *Water purification, *Water quality control, Absorption, Running waters, Thin films, Separation techniques, Oil slicks, Bilge water.

An apparatus removes from the surface of water oil contamination particularly in the form of very thin films known as 'rainbows'. It comprises purifying stages each containing small independent free-floating pads of buoyant material preferentially absorptive of oil in the presence of water. The contaminated water is passed through the purifying stages in succession. Two embodiments are shown, one adapted for use to purify the surfaces of bodies of running water such as streams or canals, and one for use in purifying effluents such as bilge water of vessels being pumped from them. (Sinha-OEIS)
W79-05961

NORTH CAROLINA 208 CASE STUDY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 6E.
W79-05969

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

APPLICATION OF HYDRAULIC AND HYDROLOGIC DATA IN URBAN STORMWATER MANAGEMENT,
Geological Survey, Oklahoma City, OK. Water Resources Div.
T. L. Huntzinger.
Geological Survey open-file report 78-414, October 1978. 33 p, 24 fig, 4 tab, 4 ref.

Descriptors: *Floods, *Urban hydrology, *Flood control, *Flood forecasting, *Analytical techniques, Flood plains, Storm runoff, Flood profiles, Rating curves, Step-backwater computations.

Techniques are described for using flood-insurance study information from the Federal Insurance Administration to analyze flood plain management alternatives. A method of developing rating curves which relate flood discharge to flood elevation is explained. Graphical methods of determining urban flood discharges are used in conjunction with rating curves to develop flood profiles resulting from future urban development. The graphical techniques were compared with standard step-backwater computations for two storms and errors were less than 0.5 foot, which are well within acceptable limits. (Woodard-USGS)
W79-05588

A DEMONSTRATION OF AREA WIDE WATER RESOURCES PLANNING,
Metropolitan Washington Council of Governments, Washington, DC.
C. S. Spooner, J. Promise, and P. H. Graham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 750, Price codes: A10 in paper copy, A01 in microfiche. Report EPA-600/5-78-0062, April 1978. 184 p, 31 fig, 138 ref, 4 append. 802149. EPA 16110 FE9 and S-802149.

Descriptors: *Water resources planning, *Water quality, *Waste water treatment, *Resource allocation, *Computer model, *Water resources management, *Framework model, *Land use planning, *Washington DC Metropolitan Area, Social impacts, *Water runoff, Cost-benefit analyses, Environmental effects, 208 Areawide Planning, Potomac Estuary Model, Models, Water supply, Water pollution sources, Simulation, Storm runoff, Impact analysis.

This study was undertaken to meet four basic objectives: to develop a comprehensive water resources planning model for the metropolitan Washington Council of Governments (MWCOG) area, especially to evaluate the effects of physical growth on present water resources; to select an appropriate computer model (s) capable of simulating key components of the area's water resource system; to identify water quality management options available to the MWCOG; and to test the effectiveness of an accepted water resources planning model by evaluating the cost effectiveness of six alternative areawide water resources management strategies. Findings concluded that the MWCOG model is a versatile and sophisticated tool, capable of analyzing the areawide water resources program and the fiscal, environmental, and social impacts of the areawide strategies emanating from the model; and that the model can be used satisfactorily to meet the standards as provided in Section 208 of the Federal Water Pollution Control Amendments of 1972. Physical simulation elements of the Framework Model were refined and improved, including community development, water demand, sewage generation, stormwater runoff, waste treatment management, and receiving water components. Also refined were the model's impact analysis elements; water quality, objectives, natural resources impact, cost, financial arrangements, social impact, and implementability. (See also W79-05715) (Arnold-NC)
W79-05714

A DEMONSTRATION OF AREAWIDE WATER RESOURCES PLANNING--USERS MANUAL,
Metropolitan Washington Council of Governments, Washington, DC.
C. S. Spooner, J. Promise, and P. H. Graham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 205, Price codes: A10 in paper copy, A01 in microfiche. Report EPA-600/5-78-006b, April 1978. 195 p, 23 fig, 10 tab, 32 ref, 4 append. 68-01-3704.

Descriptors: *Water resources planning, *Computer models, *Washington, DC. Metropolitan Area, *Potomac Estuary model, *Framework model, *Water resources management, Systems analysis, Land use planning, Water supply, Data collection, Social aspects, Environmental effects, Resource allocation, Areawide waste treatment management, Water pollution sources, Models, Impact analysis, Wastewater treatment, Simulation, Storm runoff.

This manual was written to be used in conjunction with the main report, which analyzed and recommended refinements to the water resources planning model used by the Metropolitan Washington Council of Governments (MWCOG). Twelve computer model components are described for use as a general guide to developing an individual water resource planning model for other areas. Model components (with program names in parentheses) include empiric activity allocation (EMPIRIC), interfacing of community development alternatives model with the water demand model (INTERFACE 4), estimation and forecasting of municipal water requirements (MAIN 11), adaptation of MAIN 11 data into programs for municipal water use and sewage flows (FIXSEWER), municipal water use (MUNWATER), sewage flows (SEWAGE), conversion of EMPIRIC data to a more useable form (EMPDA), preparation of data for Stormwater Management Model (PRESTORM), stormwater data (STORMWATER MODEL), determination of stormwater flow from natural watershed drainage (SPLIT), simulation of alternative wastewater treatment management option (TREATMENT), and a modeling of the hydraulics and quality constituents of the Potomac Estuary during storm and dry conditions (POTOMAC ESTUARY MODEL). (See also W79-05714) (Arnold-NC)
W79-05715

STORM WATER MANAGEMENT FOR LITTLE LEHIGH AND CEDAR CREEK DRAINAGE BASINS,
Lehigh Univ., Bethlehem, PA.
For primary bibliographic entry see Field 4A.
W79-05721

URBAN STORMWATER MANAGEMENT AND TECHNOLOGY: UPDATE AND USER'S GUIDE,
Metcalf and Eddy, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5G.
W79-05725

ECONOMICS OF WATER DEVELOPMENT IN LESS DEVELOPED COUNTRIES,
For primary bibliographic entry see Field 6B.
W79-05750

HYDROGEOLOGY AND COMPUTER MODEL OF THE BASS LAKE AREA, ST. CROIX COUNTY, WISCONSIN,
Department of Geology and Geophysics, University of Wisconsin-Madison.
For primary bibliographic entry see Field 2H.
W79-05795

A PRINT-PLOT DISPLAY SYSTEM FOR A LINEAR PROGRAMMING-BASED RESOURCES PLANNING MODEL,
Water Resources Research Center, University of Hawaii, Honolulu, Hawaii.
T. Liang, and P-S. Leung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 418, Price codes: A04 in paper copy, A01 in microfiche. Technical Memorandum Report No. 59, November 1978. 51 p, 17 fig, 1 tab, 2 append. OWRT B-053-HI(1). 14-34-0001-8013.

Descriptors: *Planning, *Model studies, Data display, Data transmission.

Many resource planning models have been developed, but few have been implemented. Frequently, months are needed to prepare inputs for a few seconds of analysis. The analysis output again requires weeks of plotting for easy comprehension. Although analysis time has been reduced drastically, preparation of inputs and display of outputs have become bottlenecks to the acceptance of most resource models. Planning is usually an iterative process. Original inputs must be frequently referenced to generate new planning actions. For example, transferring of water from wet to dry areas requires study of existing water supply conditions spatially. Creating an efficient input data basis for fast retrieval and display will speed up the planning process. The iterative process generates a large volume of output which must be quickly displayed, a fact which requires a fast display system. A print-plot display system for both inputs and outputs was developed to improve the planning process based on the resource model developed earlier by Liang (1976, 1978).
W79-05797

FEASIBILITY STUDY FOR DEVELOPMENT OF A TRANSIENT THREE-DIMENSIONAL GROUNDWATER FLOW MODEL UTILIZING THE FINITE ELEMENT METHOD,
Maryland Univ., College Park. Water Resources Research Center.
For primary bibliographic entry see Field 2F.
W79-05799

SUBSURFACE DRAINAGE MODEL WITH ASSOCIATED SEDIMENT TRANSPORT,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 2J.
W79-05802

APPLICATIONS OF REMOTE SENSING TO WATER RESOURCES,
ECOsystems International, Inc., Gambrills, MD.
For primary bibliographic entry see Field 7B.
W79-05840

FLOOD-PLAIN DELINEATION FOR OCCOQUAN RIVER, WOLF RUN, SANDY RUN, ELK HORN RUN, GILES RUN, KANES CREEK, RACOON CREEK, AND THOMPSON CREEK, FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
P. L. Soule.
Geological Survey open-file report 79-215, 1978. 118 p, 86 fig, 8 tab, 4 ref.

Descriptors: *Flood forecasting, *Flood recurrence interval, *Flood profiles, *Flood plains, *Analytical techniques, Flood frequency, Land use, Urbanization, Topography, Virginia, *Fairfax County, *Flood boundary maps, Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, Thompson Creek.

Water-surface profiles of the 25-, 50-, and 100-year recurrence interval discharges have been computed for all streams and reaches of channels in Fairfax County, Virginia, having a drainage area greater than 1 square mile except for Dogue Creek, Little Hunting Creek, and that portion of Cameron Run above Lake Barcroft. Maps having a 2-foot contour interval and a horizontal scale of 1 inch equals 100 feet were used for base on which flood boundaries were delineated for 25-, 50-, and 100-year floods to be expected in each basin under ultimate development conditions. This report is one of a series and presents a discussion of techniques employed in computing discharges and profiles as well as the flood profiles and maps on which flood boundaries have been delineated for the Occoquan River and its tributaries within Fairfax County and those streams on Mason Neck within Fairfax County tributary to the Potomac River. (Woodard-USGS)
W79-05986

MATHEMATICAL MODELS AND BORDER IRRIGATION DESIGN,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 3F.
W79-05991

6B. Evaluation Process

TRADITIONAL PERCEPTABILITIES (SIC.) OF ENVIRONMENT AND DESERTIFICATION: A CASE STUDY,
Central Arid Zone Research Inst. Jodhpur (India).
S. P. Malhotra.
Economic Geography, Vol. 53, No. 4, p 347-352, Oct. 1977. 2 tab, 4 ref.

Descriptors: *Desertification, *Environmental effects, *India, *Environmental engineering, *Land management, *Comprehensive planning, Rainfall, Winds, Soil analysis, Land use, Exploitation, Social aspects, Water management(Applied), Arid lands, Human population, Marginal productivity, Biodegradation, Reforestation, Optimum development plans, Non-structural alternatives.

The Luni Panchayat Samati community Development Block, located in the district of Jodhpur, India, is the subject of this case study to illustrate the traditional causes and necessary remedies of increasing desertification in this water-stressed arid region. Environmental stresses, general land conditions, rainfall, wind direction, flora and fauna, agricultural changes and famine periods within the 2000 square kilometers of the development block, indicate that increasingly harsh climatic factors as well as the dual increase in population and its need have been the principal factors causing and perpetuating desertic conditions. Soil impoverishment and lower productivity are the results of excessive biotic interference, improper land use, increasing cultivation of marginal lands, and over exploitation of woody biomass. Foremost among needed remedies to this situation are population control, education, and non-agricultural vocation development. It is evident from this case study that proper management techniques must include the conversion of marginal lands into pasture, an emphasis upon quality livestock over quantity, and the development of alternative sources of fuel to curb the indiscriminate cutting of trees and shrubs. (Tickes-Arizona)
W79-05562

THE RELATIONSHIP BETWEEN ECONOMIC DEVELOPMENT AND ECOLOGICAL DEGRADATION: HOW DEGRADATION HAS OCCURRED IN WEST AFRICA AND HOW ITS PROGRESS MIGHT BE HALTED,
London School of Hygiene and Tropical Medicine (England). Dept. of Medical Protozoology.
W. E. Ormerod.
Journal of Arid Environments, Vol. 1, No. 4, p 357-379, Dec. 1978 3 tab, 4 fig, 57 ref.

Descriptors: *Economic justification, *Droughts, *Soil erosion, *Rainfall intensity, *Seasonal, *Biodegradation, Planning, Alternative planning, Productivity, Economic feasibility, Exports, Agroclimatology, Grazing, Land use, Carrying capacity, Forest conservation, Projections, Arid lands, West Africa, Water management(Applied).

The purpose of this paper is to illustrate through recent events in West Africa, that economic development and agricultural exploitation in arid regions have been primary causes for the creation of deserts. Stimulated by increased economic demand, the growth of both herds and arable farming for short-term benefits from cash-export crops, are causing intense competition for land in the range areas of West Africa. The major factors which emerge as principal causes of physical deterioration of rangeland in the arid Sahelian and Sudan regions are tropical rainfall highly concentrated in a short time period, high temperatures, drought, and the decrease of soil fertility when subjected to overgrazing and other excessive land uses. The resulting degradation has significantly affected the climatology of the area and increased desiccation at the fringes of these desert regions. Emphasized in the search for possible solutions to these problems is the need to develop quantitative techniques to assist agricultural planners with improved water management, and assess the overall capacity of these areas in relation to the demand for food and economic growth. Development plans must be made in the context of preventing further soil degradation, wasteful water use, or climatic change. Possible strategies of disease control, forest conservation, and food production are suggested here to achieve these ends. (Tickes-Arizona)
W79-05565

THE CAP - WHO NEEDS IT.
Arizona Society of Professional Engineers Phoenix.
F. Welsh.
Arizona Professional Engineer, Vol. 30, No. 7, p 7 and 21, July, 1978. 1 fig.

Descriptors: *Arizona, *Economic feasibility, *Cost-benefit analysis, Central Arizona Project, Water resources development, Groundwater availability, Forecasting, Economic impact, Political aspects, Planning, Project post-evaluation, Water management(Applied), Economic justification, Area redevelopment.

This analysis questions the value of the Central Arizona Project (CAP) by attempting to show that while utilizing massive amounts of energy and tax dollars, the project does little to solve the needs of modern Arizona. Projections by the Arizona Water Commission and the U.S. Geological Survey indicate that groundwater reserves are sufficient to supply both Tucson and Phoenix for at least 100 more years and that population projections for the year 2034 of 5.5 million is only half of what can be supported with present water supplies. Agricultural use of CAP water also does little to justify the project as agriculture already consumes 89% of our water, returns only about 5% to our personal income, consumes 9% of the nation's natural resources, and provides only 1% of America's crop production. Citing economic data provided by University of Arizona and University of Montana economists, this author illustrates how a negative benefit/cost ratio is the result of the projection that CAP water would rescue only 0.07% of our personal income. Questioning the judgment of State and Federal administrators, it is contended here that the best course of action would have been to develop existing land and water projects further rather than to initiate this costly and largely inefficient program. (Tickes-Arizona)
W79-05568

SYNTHESIS AND CALIBRATION OF A RIVER BASIN WATER MANAGEMENT MODEL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. M. Shafer, and J. W. Labadie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 850, Price codes: A05 in paper copy, A01 in microfiche. Environmental Resources Center, Colorado State University Completion Report No. 89. October 1978. 68 p, 15 fig, 14 tab, 19 ref. OWRT A-039-COLO(1).

Descriptors: *Simulation, *Water supply, *River basins, *Network analysis, Interbasin water transfers, Streamflow, Reservoir storage, Water conveyance, Diversion, Computer models.

A computer model is presented for the analysis of large scale water resources policy changes. The model is designed to aid in the investigation of the impact of volumetric transfers of water, on a monthly basis, throughout a system of interconnected storage and demand centers. The model is capable of considering the ordered preference of demand satisfaction versus storage retention throughout the network. An interactive, conversational data management program has also been interfaced with the model to facilitate the rapid analysis of varying management alternatives. The case study approach is used to present the model and demonstrate its application. The Cache la Poudre River Basin in north-central Colorado is modeled to determine the availability of a firm water supply for the proposed Rawhide Project. By contract, this firm water supply must be composed of reusable foreign water diverted and first used by the City of Fort Collins, Colorado. A detailed model calibration study was undertaken and presented in its entirety. Three years of complete storage and diversion data were available from the Colorado Water Data Bank on which model calibration was based. Upon successful model calibration, two management strategies were outlined for the actual analysis of opportunities for Fort Collins to meet Rawhide Project water needs.
W79-05583

A DEMONSTRATION OF AREA WIDE WATER RESOURCES PLANNING,
Metropolitan Washington Council of Governments, Washington, DC.
For primary bibliographic entry see Field 6A.
W79-05714

A DEMONSTRATION OF AREAWIDE WATER RESOURCES PLANNING--USERS MANUAL,
Metropolitan Washington Council of Governments, Washington, DC.
For primary bibliographic entry see Field 6A.
W79-05715

EVALUATION OF PLANNING FOR FISH AND WILDLIFE, LAKE SHARPE RESERVOIR PROJECT,
Sport Fishing Inst., Washington, DC.
For primary bibliographic entry see Field 6G.
W79-05717

Group 6B—Evaluation Process

THE PERCEPTION AND VALUATION OF WATER QUALITY: A REVIEW OF RESEARCH METHOD AND FINDINGS,
Regional Science Research Inst., Philadelphia, PA.
R. E. Coughlin.
Discussion Paper Series No. 80, June 1975. 43 p, 5 fig. 68-01-199.

Descriptors: *Water quality, *Social values, *Water values, *Water resources, *Attitudes, *Environmental assessments, Aesthetics, Water pollution, Bodies of water, Evaluation, Measurement, Testing procedures, Surveys, Limnology, Multiple regression, Research methods, Stream quality, *Perceptions.

The purpose is to discuss some of the methodological considerations in measuring people's perception of water quality, and to review research which has been done on this subject, thereby providing a basis for the exploration of where research and policy should go from here. Many of the effects of pollution go beyond physical health and economics and enter the realm of value systems. General problems in measuring perception include agreement and differentiation among observers concerning a particular environment, establishing a connection between perception and physical measurement of the environment and replicating measurements over time and different observers. Specific methodological problems concern replicating the experimental setting for different observers, and whether to take the observers to the sites of water pollution, or find people on or nearby the site and determine their perceptions. The report describes and cites research efforts on various aspects of the perceptions and evaluation of water quality; the physical, chemical, and biological characteristics of a water body; the perceptions which are held of these characteristics; the resulting preferences and attitudes towards the water body; and the uses to which the water body is put. The report urges two-dimensional and multi-dimensional trade-off studies to scale many of the values people assign to water quality. (Coan-NC)
W79-05723

SELECTED PRIORITIES: 1978-82--A FIRST-YEAR EFFORT RECOMMENDING PRIORITIES FOR SELECTED FEDERAL WATER AND RELATED LAND RESOURCE PROGRAMS IN NEW ENGLAND.
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 6E.
W79-05724

URBAN STORMWATER MANAGEMENT AND TECHNOLOGY: UPDATE AND USER'S GUIDE,
Metcalf and Eddy, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5G.
W79-05725

ECONOMICS OF WATER DEVELOPMENT IN LESS DEVELOPED COUNTRIES,
L. D. James.
Water Supply and Management, Vol 2, No 4, p 373-386, 1978. 24 ref.

Descriptors: *Developing countries, *Water resources development, *Econonics, *Planning, *Methodology, *Research priorities, Governments, Technology, Economic feasibility, Economic efficiency, Economic development, Cost-benefit analysis, Irrigation, Water supply, Political aspects, Analytical techniques, Environmental effects, Social aspects, Social impact, Social participation.

The evolution of water resources planning in the U.S. has produced a set of principles, standards, and procedures for guiding further water development which might be adaptable to needs of developing countries. This paper describes how to accomplish such a modification of theory and practice, set down by the U.S. Water Resources Council (1977). There are five planning components: (1) project purposes, (2) planning objectives, (3) project level, (4) feasibility tests, and (5) project design. Each component is evaluated, and several research priorities are identified: (1) upgrade feasibility study quality; (2) develop water planning objectives and a planning methodology through interaction among political leaders, professional planners, and technical experts; (3) standardize such procedures as those for determining shadow prices for estimating economic value in feasibility studies; (4) develop better procedures for estimating indirect and secondary benefits; (5) define ecological impacts of water resources development in tropical areas and socio-cultural impacts in developing countries; and (6) determine the proper mix of nonstructural and structural, individual and group water management programs for a given area to promote economic self-sufficiency in the country, and develop methods for training people to make the best use of the water resource facilities provided. (Lynch-Wisconsin)
W79-05750

PERILS OF THE ORDERLY MIND: COST-BENEFIT ANALYSIS AND OTHER LOGICAL PITFALLS,
Gilbert/Commonwealth, Reading, PA.
J. Ghiselin.
Environmental Management, Vol 2, No 4, p 295-300, July 1978. 48 ref.

Descriptors: *Environmental effects, *Economics, *Cost-benefit analysis, *Analytical techniques, *Theoretical analysis, *Problem identification and ranking, Federal government, Cost-benefit theory, Political constraints, Legal aspects, Regulation, Methodology, Decision-making, Planning, Judicial decisions, Quantification, Monetization, Mathematics, Resource management, Scientific method.

Several procedures in general use in environmental cost-benefit analysis are based upon serious theoretical errors, in particular the notion that all variables can be quantified, and the basic mathematical fallacy that outcomes of unrelated activities can be ranked on a single scale. An underlying theoretical mistake is application of the scientific method, usable only for decisions premised on numerical measurements or at least scalar values, to decisions which are not numerical but are based on taste or judgment, such as in music, aesthetics, or drama. Some fields, including architecture or medicine, require both scientific and artistic skill. Monetization of costs and benefits is delusive because: (1) it ignores aspects which cannot be monetized, and (2) it is inaccurate to the extent of the least precise estimate included (the weakest link principle). Environmental regulations generally recognize the impossibility of assessing all effects in quantitative terms, and instead require that all environmental effects be considered and weighed one against another where possible. Weighing of costs and benefits was formally required in a 1971 U.S. Court of Appeals decision (the Calvert Cliffs decision). This decision led to attempts to quantify innumerable findings and opinions in a multitude of fields activity areas. This paper proposes as an alternative that such decisions be placed in the hands of qualified judges who can assess differing effects (determined by experts) using whatever standards a particular evaluation may call for. (Lynch-Wisconsin)
W79-05751

AN ECONOMIC ANALYSIS OF PHOSPHORUS CONTROL AND OTHER ASPECTS OF R76-1,
DePaul Univ., Chicago, IL.
For primary bibliographic entry see Field 6E.
W79-05752

ECONOMIC IMPACT OF PROPOSED AMENDMENTS TO WATER POLLUTION REGULATIONS, R77-12, DOCKET A.
Harza Engineering Co., Chicago, IL.
For primary bibliographic entry see Field 6E.
W79-05753

THE EFFECT OF WATER POLLUTION CONTROL REGULATIONS ON THE COST OF PRODUCTION OF ELECTRIC POWER,
Auburn Univ., AL. Water Resources Research Inst.
T. A. Deyak, and A. N. Link.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 270, Price codes: A03 in paper copy, A01 in microfiche. Bulletin 36, March 1979, 24 p, 1 fig. OWRT A-062-ALA(1).

Descriptors: Federal Water Pollution Control Act, *Electric power production, Costs, *Regulations, Utilities, Heated water.

The purpose is to examine the impact of water pollution control regulations, as outlined by the 1972 Amendment to the Federal Water Pollution Control Act, on the production process of U. S. steam-electric utilities. The major thrust of this 1972 Amendment and of the subsequent state and local pollution policies is to limit the amount of pollutants which business firms, municipalities, and consumers may discharge into the environment. Specifically, two national goals pertaining to water quality were established: (1) to eliminate the discharge of pollutants into navigable waters by the year 1985 and (2) to provide by the year 1983 a level of water quality sufficient to protect life and recreation in and on the water. Since the operation of steam-electric plants involves the disposal of large quantities of waste heat into surface waters or into the air, it has been one industry significantly affected by these legislations. This analysis finds that utilities subject to these pollution control regulations are able to adjust their production technologies to partially internalize the increased costs associated with meeting the abatement standards. However, firms subject to stringent regulations will have no choice but to pass the increase in production costs directly to the consumer if they expect to maintain their existing levels of profit.
W79-05796

CLASSIFICATION OF EVALUATION OF FLOOD FLOW FREQUENCY ESTIMATION TECHNIQUES,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-05844

RAPIDLY OBTAINING OPTIMAL IRRIGATION SYSTEM DESIGNS,
Idaho Univ., Aberdeen.
For primary bibliographic entry see Field 3F.
W79-05993

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PRICING IRRIGATION WATER IN MEXICO: EFFICIENCY, EQUITY AND REVENUE CONSIDERATIONS,
Michigan Univ., Ann Arbor. Dept. of Resources Economics.
G. Schramm, and V. F. Gonzales.
The Annals of Regional Science, 15-35, March, 1977 3 tab, 3 fig, 35 ref.

Descriptors: *Water utilization, *Efficiencies, *Water costs, *Irrigation water, *Mexico, *Competitive prices, *Economic impact, Competing uses, Water consumption(Except consumptive use), Adjusted prices, Average prices, Equity, Water rates, Economic analysis, Fixed costs, Income, Institutional constraints, Legal aspects.

If irrigated agriculture is to be expanded in the arid regions of Mexico, where 91% of the potentially available water resources are currently exploited, greater water use efficiency must be achieved. It is these authors' contention that an effective instrument to bring about such an improvement is an appropriate water pricing structure. Accordingly, a brief view of the water problem in Mexico is followed here by discussions of the legal and con-

ceptual issues related to the pricing of water. Although economists generally agree that an efficient utilization of water resources can be brought about by the application of the principle of equi-marginal value in use, empirical findings show that Mexican irrigation farmers pay, on the average, less than 10% of the actual water costs. Results of this same study indicate water use efficiencies to be less than 50%, although this figure is markedly higher in irrigation districts with volumetric compared to fixed water charges. Based upon the need to change existing conditions, some representative pricing structures are presented designed to account for both efficiency and income distribution goals. It is pointed out, however, that the implementation of the policies presented here have formidable political, institutional and legal obstacles to overcome. (Tickes-Arizona)
W79-05566

THE CAP - WHO NEEDS IT.
Arizona Society of Professional Engineers Phoenix.
For primary bibliographic entry see Field 6B.
W79-05568

CONGESTION, POLLUTION, AND IMPURE PUBLIC GOODS,
Arizona State Univ., Tempe. Dept. of Economics.
A. C. Deserpa.
Public Finance, Vol 33, No 1-2, p 68-83, 1978. 1 fig, 1 tab, 1 fig, 25 ref, 1 append.

Descriptors: *Externalities, *Economics, *Air pollution, *Public goods, *Impure public goods, *Congestion, Optimization, Model studies, Mathematical models, Waiting, Classification, Theoretical analysis.

Three general classes of congestion are defined and formally incorporated into the impure public goods model. This paper examines optimality conditions of the impure public good model under the three classes of externality. Two classes conform to the Rothenberg-Haveman distinction between congestion and pollution, while the third deals with an intermediate class typified by queuing. Congestion and pollution are distinguished by separability of the activity which begets the externality from the actual consumption of the externality. Pollution is consumed by each inhabitant of the polluted area independently of his contribution to the pollution; pollution is thus 'purely separable' from the cause. By contrast the individual causes the congestion in proportion to his participation in the activity (such as time loss on a highway) and the individual bears the external cost at the margin, unlike the case of pollution. Waiting fits neither category, representing a set-up cost which reduces each participant's economic surplus, but the extent of the wait is independent of length of participation in the activity. This type of externality is termed 'discretely separable'; waiting is inseparable from the cause, but the participant bears no cost at the margin. (Lynch-Wisconsin)
W79-05748

STANDARD SETTING AND THE THEORY OF INSTITUTIONAL CHOICE: THE CASE OF POLLUTION CONTROL,
D. J. Storey.
Policy and Politics, Vol 6, No 4, p 421-424, 1977.

Descriptors: *Water pollution control, *Economics, *Pollution taxes(Charges), *Water quality standards, *Policy, *Institutional constraints, *Political constraints, United States, United Kingdom, Costs, Marginal costs, Regulation, Information requirements, Equity, Enforcement.

Economic arguments and historical reasons explain why effluent charges have not been adopted in the United States and United Kingdom for water pollution control. This paper counters Majone's argument (1975) that political or bureaucratic self-interest is responsible for opposition to effluent charges and continued adherence to the water quality standards approach. Majone maintains that effluent charges are demonstrably superior to other policies. But this study argues that in terms of information requirements, equity, and effectiveness the standards approach equals or betters the effluent charge system. Information requirements are in fact comparable for the two systems, despite claims that no costly information gathering is needed for effluent charges. Majone ignores equity; under an effluent charge system all firms are subject to the same tax, but those with lowest marginal abatement costs carry most of the burden of abatement, and since these firms may be those most likely to go out of business, local unemployment may result. The effluent tax cannot account for such complications. Majone cites the U.S. experience to show the failure of the standards approach, but data from the U.K. support the opposite conclusion. Finally, effluent taxes have been seriously considered only in recent years and by economists, for whom public esteem in not high, and engineering standards therefore have remained unchallenged. (Lynch-Wisconsin)
W79-05749

A NOTE ON THE ECONOMIC SIGNIFICANCE OF UNIFORM WATER APPLICATION,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W79-05816

6D. Water Demand

SUMMARY OF THE WATER RESOURCES OF PUERTO RICO,
Geological Survey, San Juan, PR. Water Resources Div.
H. J. McCoy.
Geological Survey open-file report 78-971, October 1978. 17 p, 6 fig, 8 ref.

Descriptors: *Water resources, *Puerto Rico, *Hydrologic data, *Water quality, Surface waters, Groundwater, Hydrologic budget, Rainfall, Water utilization, Streamflow, Runoff, Evapotranspiration, Groundwater movement, Water supply, Water demand.

Puerto Rico has considerable variability in geology, hydrology, and topography. Rainfall provides an average of about 11,600 million gallons of water per day. The mountainous interior receives the most rainfall and the southwest coast the least. Surface water accounts for about 90 percent of public supplies but only about 20 percent of industry; agriculture uses about equal amounts of ground water and surface water. Of the average daily 11,600 million gallons of precipitation, about 7,240 Mgal/d is lost by evapotranspiration; about 3,620 Mgal/d by streamflow to the sea; and about 188 Mgal/d by ground-water flow to the sea. Municipal, industrial, and agricultural uses account for about 420 Mgal/d in losses. The south coast is the most stressed area in terms of water deficiency. Changes in water use and the importation of water are alternatives for increasing supplies to meet future demands. Generally the chemical composition of nearly all surface waters in Puerto Rico is about the same (Bogart, 1964, p. 86). The waters are predominantly of the calcium bicarbonate type. However, characteristic differences do occur--especially in dissolved solids and in concentration of specific ions. (Woodard-USGS)
W79-05592

APPLICATIONS OF REMOTE SENSING TO WATER RESOURCES,
ECOsystems International, Inc., Gambrills, MD.
For primary bibliographic entry see Field 7B.
W79-05840

WATER AND ENERGY IN THE WESTERN COAL LANDS,
Office of Technology Assessment, Washington, DC.
S. E. Plotkin, H. Gold, and I. L. White.
Water Resources Bulletin, Vol. 15, No. 1, p 94-107, February 1979. 5 fig, 18 ref.

Descriptors: *Energy, *Colorado River, *Colorado, Coals, Water quality, Water resources, Water supply, Conservation, Water conservation, Water requirements, Agriculture, Crops, Cooling, Water law.

Problems of water quality and quantity are critical to development of the energy resources of the Western U.S. Based on a number of independent measures, the Upper Colorado River Basin is expected to experience severe water availability problems in a few decades if projected energy and agricultural development occurs. Given the impending collision between the competing interests of various water users, water resource management and conservation deserve the utmost attention. Substantial opportunities for conservation exist in energy and agricultural development. Selection of both conversion and cooling technologies and careful siting decisions can sharply reduce the water requirements of energy development. Agricultural water conservation strategies include improving irrigation and cultivation practices, removing phreatophytes, removing marginal lands from production, and changing crop patterns. In order to accomplish significant conservation, there must be changes in those aspects of water law that remove conservation incentives from the water use system. (Roberts-ISWS)
W79-05845

RECONNAISSANCE EVALUATION OF WATER RESOURCES FOR HYDRAULIC COAL MINING, CRESTED BUTTE COAL FIELD, GUNNISON COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
W. M. Alley, L. J. Britton, and E. L. Boyd.
Availability: OFSS, USGS Box 25425, Den. Fed. Ctr. Denver, CO. 80225 microfiche $3.50, paper copy $3.75. Geological Survey open-file report 78-938, December 1978. 23 p, 6 fig, 6 tab, 20 ref.

Descriptors: *Surface water availability, *Groundwater availability, *Coal mines, *Hydraulic mining, *Water quality, Low flow, Streamflow, Water wells, Data collections, *Colorado, *Gunnison County, *Crested Butte coal field.

Available surface-water and ground-water data were compiled for the parts of the Gunnison River basin in and adjacent to the Crested Butte coal field. The data were evaluated to assess the quantity and quality of water resources in the area for use in hydraulic coal mining. Based on discharge records, surface-water supplies of most streams should be adequate to meet the demands for hydraulic mining of 1 million tons of coal per year with a recycled water system. However, on some of the smaller streams in the area, some storage of water may be required for use during low-flow periods to meet minimum-flow requirements for downstream reaches. Other potential sources of water for hydraulic coal mining include ground water from alluvium along major streams and from the Dakota and Entrada Sandstones. The surface and ground water in the study area should be of adequate quality for use in hydraulic coal mining, with the possible exception of Coal Creek which has excessive concentrations of iron, manganese, and zinc. Data are insufficient to assess the potential impact of hydraulic coal mining on downstream water quality. (Woodard-USGS)
W79-05975

WATER RESOURCES OF THE UPPER DUCK RIVER BASIN, CENTRAL TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
C. R. Burchett.
Tennessee Division of Water Resources, Water Resources Series No 12, 1977. 103 p, 52 fig, 11 tab, 31 ref.

Descriptors: *Groundwater resources, *Surface waters, *Water quality, *Available water, *Water supply, Hydrogeology, Aquifer characteristics, Water utilization, Water demand, Water wells, Water yield, Groundwater recharge, Streamflow,

Water analysis, Hydrologic budget, Tennessee, *Upper Duck River basin.

Cherty carbonate bedrock underlying the Highland Rim physiographic province in central Tennessee weathers in place to form 20 to 90 feet of unconsolidated material grading from clay-sized chert residuum at land surface to chert rubble at depth. This chert rubble zone and (or) solution openings within the bedrock have been named the Manchester aquifer. Test wells, selected by specific criteria, have penetrated zones that produce over 500 gallons per minute. The Manchester aquifer is separated from the Central Basin physiographic province by an impermeable, 25-foot-thick basal shale. Many springs occur along the Highland Rim escarpment above the shale. Below the shale is a series of relatively pure, dense limestones. Ground water is available to wells from solution openings within the bedrock. Bentonite beds, which underlie a large part of the Central Basin, are water-tight. Wells unaffected by the bentonites can produce 100 gallons per minute or more. The 7-day 10-year low flow of streams varies from 0 to 0.392 cubic feet per second per square mile. The largest flows are along the Highland Rim escarpment; the lowest flows are within the Highland Rim and Central Basin provinces. (Woodard-USGS)
W79-05985

RECONNAISSANCE EVALUATION OF WATER RESOURCES FOR HYDRAULIC COAL MINING, GRAND HOGBACK COAL FIELD, GARFIELD AND RIO BLANCO COUNTIES, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
W. M. Alley, L. J. Britton, and E. L. Boyd.
Available from the USGS, OFSS Box 25425, Den. Fed. Ctr. Denver CO 80225 paper copy $6.00, microfiche $3.50. Geological Survey open-file report 78-885, November 1978. 37 p, 9 fig, 8 tab, 20 ref.

Descriptors: *Surface water availability, *Groundwater availability, *Coal mines, *Hydraulic mining, *Water quality, Low flow, Streamflow, Water wells, Data collections, *Colorado, *Garfield County, *Rio Blanco County, *Grand Hogback coal field.

Surface-water and ground-water data were compiled for the parts of the Colorado River and the White River basins in and adjacent to the Grand Hogback coal field. The data were evaluated to assess the quantity and quality of water resources available in the area for use in hydraulic coal mining. Based on discharge records, surface-water supplies of most streams should be adequate to meet the demands for hydraulic mining of 1 million tons of coal per year with a recycled water system. However, on some of the smaller streams in the area, some storage of water may be required for use during low-flow periods to meet minimum-flow requirements for downstream reaches. Other potential sources of water include Rifle Gap Reservoir, Harvey Gap Reservoir, and ground water from valley-fill deposits along major streams and rivers. The surface water and ground water should be of adequate quality for use in hydraulic mining, with the possible exceptions of suspended-sediment concentrations that periodically may be as much as 18,800 milligrams per liter in streams in the Rifle Creek drainage, and dissolved-solids concentrations greater than 20,000 milligrams per liter in some aquifers. Data are insufficient to assess the potential impact of hydraulic coal mining on downstream water quality. (Woodard-USGS)
W79-05987

WATER SUPPLY POTENTIAL OF THE LAKE SALLY SYSTEM, MARQUETTE COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
N. G. Grannemann.
Geological Survey open-file report 78-1046, December 1978. 14 p, 6 fig, 1 tab, 12 ref.

Descriptors: *Water supply, *Surface water availability, *Water storage, *Lakes, *Water shortage, Hydrologic data, Precipitation(Atmospheric), Overland flow, Inflow, Streams, Base flow, Water demand, Water distribution(Applied), Michigan, *Lake Sally, *Ely Creek, *Marquette County(Mich).

The Lake Sally system, Marquette County, Mich., consists of six lakes in the headwaters of Ely Creek. This system is the source of water for Ishpeming and several small communities in the central part of Michigan's Upper Peninsula. Precipitation and overland runoff account for 93 percent of the water supplied to the system. Below-average precipitation in 1976 and early 1977 resulted in low lake levels and cast doubt on the system's ability to meet water demands. Water supplied to the Lake Sally system is estimated to be 2.57 cubic feet per second (cfs) when precipitation is average. Use of water by Ishpeming is about 3.5 cfs. The city obtains some water from lakes outside the system when the supply from the Lake Sally system is insufficient. Results of a base-flow investigation on Ely Creek, the outlet of the Lake Sally system, indicate that ground-water flow to the system is between 0.08 and 0.17 cfs. (Woodard-USGS)
W79-05988

6E. Water Law and Institutions

THE FOUNDING OF THE SALT RIVER WATER USERS ASSOCIATION,
J. H. Krenkel.
Journal of the West, Vol. 17, No. 1, p 82-90, Jan. 1978. 8 fig, 51 ref.

Descriptors: *Administrative agencies, *Organizations, *Water storage, *Project post-evaluation, Arizona, Cooperatives, Institutions, History, Land reclamation, Project planning, Water policy, Water resources development, Salt River Water Users Association, Dams, Reservoirs.

The history and development of water management organizations in the Salt River Valley of Arizona are traced here from 1897 to the completion of Roosevelt Dam and the formation of the Salt River Water Users Association in 1911. The irrigation and power projects existing today on the Salt and Verde Rivers are representative results of the national reclamation policies which began at the beginning of the 20th century with the intention of recovering waste lands and putting them to beneficial use. The rapid arrival of new settlers and the erratic nature of the Salt River are the principal factors which have necessitated the existence of a water users association in the Salt River Valley for the last century. The efforts of both private and governmental associations and boards to support this organization as well as to construct reservoirs and dams are traced here to illustrate the long struggles and governmental fluctuations involved in formation of the present association and the construction of the Salt River Project. Although several people were instrumental in this endeavor, it was the efforts of President Roosevelt that initiated the reclamation movement and eventual construction of Roosevelt Dam which marked the beginnings of the present Salt River Water Users Association. (Tickes-Arizona)
W79-05555

THE DARK AND BLOODY GROUND OF INDIAN WATER RIGHTS: CONFUSION ELEVATED TO PRINCIPLE,
California Univ., Los Angeles. Dept. of History.
N. Hundley, Jr.
The Western Historical Quarterly, Vol. 9, No. 4, p 455-482, Oct. 1978. 1 fig, 48 ref.

Descriptors: *Water rights, *Indian reservations, *Water contracts, *Winters doctrine, *Legal aspects, *Water allocation(Policy), Water law, Administrative agencies, Boundary disputes, Jurisdiction, Land tenure, Water utilization, Reservation doctrine, Institutional constraints, History, Political constraints, Regulation, Southwestern U.S., Arid lands.

Although the crisis of Indian water rights in the arid western U. S. can hardly be characterized as a new development, the question remains one of paramount importance to American Indian tribes in the area, an issue still clouded with confusion and still bitterly contested. Although much attention has been directed to this subject little progress has been achieved due principally to the ambiguity and contentiousness on almost every point of legal significance, including the theoretical basis of the water right itself. The problem is best understood by examining its historical development since its origins during the Indian wars and reservation policies of the late 19th century. Accordingly, a brief historical review of the legal battles over Indian water rights is presented here. Unfortunately most of the questions remain unanswered and the courts have in some cases created more problems than they have solved. It is argued here that this long standing confusion over the subject has taken on the character of a principle in Indian water law. Even if the situation were cleared up, it is further argued that long term related problems would persist. These include the insufficient number of Indians possessing the technical and managerial skills needed to guide reservation development, the problem created by fractionated ownership of land on many reservations and the reluctance of Congress and others to provide needed capital. (Tickes-Arizona)
W79-05560

ACCOMPLISHMENT PLAN, REGION VIII. RED RIVER OF THE NORTH BASIN.
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 5G.
W79-05722

SELECTED PRIORITIES: 1978-82--A FIRST-YEAR EFFORT RECOMMENDING PRIORITIES FOR SELECTED FEDERAL WATER AND RELATED LAND RESOURCE PROGRAMS IN NEW ENGLAND.
New England River Basins Commission, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 890, Price codes: A06 in paper copy, A01 in microfiche. Report, June 25, 1976. 105 p, 2 append.

Descriptors: *River basins, *River basin development, *Regional planning, *Water resources development, *New England, Economic development, Resource allocation, Land resources, Water resources, Feasibility studies, Soil Conservation Service, Geological survey, Budget allocations, Federal funding, Energy planning, Flood plain management, Groundwater surveys, Soil surveys, Data collection.

This report recommends priorities for federal investment in water and related land resource programs and projects in New England. The effort was limited to four categories of federal resource-related programs: (1) data collection; (2) planning--comprehensive 'Level B' river basin studies, special studies, and reconnaissance studies; (3) feasibility, site specific 'Level C' studies which lead to implementation; and (4) actions, design studies and project or program implementation. The data collection category was limited to the soil survey program conducted by the Soil Conservation Service (SCS) and the groundwater survey program conducted by the Geological Survey (GS). Maps, schedules, and budget allocations for soil and groundwater surveys are listed for each New England State. Priority candidates in the Planning category came from NERBC's four completed Level B studies, the Regional assessment, and other ongoing Commission activities, and from all cooperating state, federal, and regional agencies in New England. Ongoing and new start planning programs are listed with appropriate fiscal and timetable data. Candidates in the feasibility category were limited to the Level C types studies of the SCS and U.S. Army Corps of Engineers. In the

Action category, priority candidates are limited to existing Level B studies involving federal funds. Appropriation legislation, the activities of all involved federal agencies and ongoing programs are described. (Coan-NC)
W79-05724

STANDARD SETTING AND THE THEORY OF INSTITUTIONAL CHOICE: THE CASE OF POLLUTION CONTROL,
For primary bibliographic entry see Field 6C.
W79-05749

AN ECONOMIC ANALYSIS OF PHOSPHORUS CONTROL AND OTHER ASPECTS OF R76-1,
DePaul Univ., Chicago, IL.
J. E. Ciecka, R. G. Fabian, D. S. Merilatt, and T. J. Murphy.
Illinois Institute for Environmental Quality, Document No 78/16, June 1978. 121 p, 5 fig, 27 tab, 33 ref, 5 append. 80.063.

Descriptors: *Phosphorus, *Water quality standards, *Illinois, *Cost-benefit analysis, *Water pollution control, *Regulation, *Eutrophication, Model studies, Vollenweider models, Trophic level, Oligotrophy, Value, Recreation demand, Willingness-to-pay, .Travel time, Discount rates, Nutrient removal, Nutrients, Effluents, Lakes, Sewage treatment, Municipal wastes, Mathematical models, Nonpoint pollution, National pollution discharge elimination system.

An amendment proposed by the Illinois Environmental Protection Agency (PCB R76-1) to the Illinois water pollution control regulations would: (1) delete the general water quality standard for phosphorous of 0.05 mg/l, (2) add a new effluent standard for phosphorus of 1.0 mg/l applicable to discharges affecting lakes and reservoirs of 20 acres or longer, and (3) include administrative changes to make effluent standards compatible with the National Pollution Discharge Elimination System. This economic analysis concludes: (1) the 0.05 mg/l standard is not achievable due to widespread nonpoint pollution sources; (2) annual cost to 27 municipalities of meeting the 0.05 mg/l standard would be about $3.2 million, compared with $0.5-1.0 million with the 1.0 mg/l standard; (3) proposed regulations would not significantly affect agriculture, commerce and industry, or cost or availability of goods and services; (4) only one of 28 lakes examined with the Vollenweider trophic state model appears capable of achieving oligotrophic status under the proposed regulation; (5) the low probability of improving lake trophic state suggests there may be no benefits from phosphorus removal, regardless of standard; and (6) if there is lake improvement, the most tangible primary benefits will be in water-based recreation, measured by the travel cost method of demand analysis, with willingness-to-pay as a measure of net benefit. A 1% recreational use increase on nine lakes would be worth $540,000 with secondary benefits of $1.47 million in state output. (Lynch-Wisconsin)
W79-05752

ECONOMIC IMPACT OF PROPOSED AMENDMENTS TO WATER POLLUTION REGULATIONS, R77-12, DOCKET A.
Harza Engineering Co., Chicago, IL.
Illinois Institute for Environmental Quality, Document No 78/23, June 1978. 60 p, 2 fig, 11 tab, 12 ref, 3 append. 80.116.

Descriptors: *Illinois, *Water pollution control, *Regulation, *Water quality standards, *Sewage disposal, *Poisons, *Legislation, Toxicity, Dissolved solids, State governments, Waste treatment, Sewage treatment, Sewers, Combined sewers, Industrial wastes, Effluents, Cost-benefit analysis, Dilution ratio, Fish, Diatoms, Algae, Environmental effects, Secondary contact water, Definitions, Law enforcement.

Amendments proposed by the Illinois Environmental Protection Agency (IEPA) to certain sections of the Illinois Water Pollution Control Board rules and regulations are described, and benefits and costs resulting from them are analyzed. Identified as Docket A of IEPA Proposal R77-12, amendments consist of definition changes, one new definition, modification of certain rules, and one new rule. They are grouped into five categories: (1) sewer and sewage definition changes, (2) combined sewer regulations changes, (3) secondary contact water quality standard changes, (4) dilution ratio definition, and (5) implementation plan changes. The major benefit of the amendments would be to clarify existing regulations and their intent, which would aid in enforcement and avoid litigations. Monetary benefits would result from elimination of variance requirements for combined sewer construction and less stringent effluent requirements due to the change in dilution ratio definition. These savings, though significant on an individual case basis, would not have secondary effects on agriculture, local government, commerce or industry, employment, or cost and availability of goods and services. Major costs would be related to control of total dissolved solids (in the form of eliminating violations) and control of toxic substances. The occasional total dissolved solids levels exceeding 1000 mg/l appear to be due to nonpoint sources, the control costs of which could not be assessed. (Lynch-Wisconsin)
W79-05753

FOURTH NATIONAL WORKSHOP ON ENTRAINMENT AND IMPINGEMENT,
For primary bibliographic entry see Field 5C.
W79-05754

IMPLEMENTATION OF SECTION 316 OF THE FEDERAL WATER POLLUTION CONTROL ACT,
Environmental Protection Agency, Washington, DC. Permit Program Div.
For primary bibliographic entry see Field 5C.
W79-05755

THE POWER PLANT REGULATORY PROGRAM: A CONGRESSIONAL DILIMMA,
Committee on Public Works and Transportation (U.S. House).
For primary bibliographic entry see Field 5C.
W79-05756

REGULATORY DEVELOPMENTS IN SECTION 316(B),
Environmental Protection Agency, Chicago, IL. Enforcement Div.
For primary bibliographic entry see Field 5C.
W79-05757

THE ROLE OF THE SCIENTIST IN THE SECTION 316 PROCESS: A LAWYER'S POINT OF VIEW,
LeBoeuf, Lamb, Leiby and MacRae, New York.
For primary bibliographic entry see Field 5C.
W79-05758

CENTER PIVOT IRRIGATION IN THE COLUMBIA BASIN OF WASHINGTON AND OREGON: DYNAMICS AND IMPLICATIONS,
Oregon State Univ., Corvallis. Dept. of Geography.
For primary bibliographic entry see Field 3F.
W79-05818

WATER AND ENERGY IN THE WESTERN COAL LANDS,
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 6D.
W79-05845

NORTH CAROLINA 208 CASE STUDY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
L. F. Horney, F. A. Koehler, F. J. HumeniK, and L. F. Bliven.
Paper No. 78-2584, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 6 p. 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: Water pollution, Water quality, Water pollution control, Water quality control, Planning, Water management(Applied), Water law, Legislation, Agriculture, North Carolina.

The North Carolina approach for the development of the agricultural portion of the statewide 208 plan has been influenced by unanswered questions concerning actual water quality and relationships beween agricultural practices, conservation techniques and areawide water quality. The planning organization and responsibilities, approaches and studies undertaken leading to plan recommendations were discussed. (Skogerboe-Colorado State)
W79-05969

6F. Nonstructural Alternatives

INFLUENCE OF NON-POINT POLLUTION SOURCES IN CONNECTION WITH THE TUY RIVER BASIN SANITATION STUDIES,
Universidad Central de Venezuela, Caracas.
For primary bibliographic entry see Field 5A.
W79-05740

6G. Ecologic Impact Of Water Development

EVALUATION OF PLANNING FOR FISH AND WILDLIFE, LAKE SHARPE RESERVOIR PROJECT,
Sport Fishing Inst., Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 097, Price codes: A05 in paper copy, A01 in microfiche. Prepared for Dept. of the Army, Office of the Chief of Engineers, Washington, DC. Oct. 1976. 70 p, 1 fig, 16 tab, 60 ref. DACW73-74-C-0040.

Descriptors: *Wildlife, *Fish, *Game birds, *Wildlife management, *Post impoundment, *Lake Sharpe Reservoir(SD), *Impoundments, *Aquatic birds, Reservoirs, South Dakota, Game management, Big Bend Dam(SD).

This study is an evaluation of the benefits and effects on fish and wildlife from the construction of the Lake Sharpe Reservoir Project on the Missouri River southeast of Pierre, S.D. The 55,800 acre lake, created by the construction of Big Bend Dam, in the middle of Crow Creek Indian Reservation was delayed by negotiations with the Crow Indians for years after project approval in 1944. After construction in 1964, studies were initiated of project impact on waterfowl, big game, upland game, and fishery resources in light of predicted data before construction, actual data occurrences after construction, and the relevance and usefulness of the inputs into the planning process itself. Findings of impact on waterfowl resources were that predictions of greater goose kills by hunters were inaccurate, that duck kills increased, while both species became more evenly distributed over the area following impoundment. Project impacts on big game such as white tailed deer, mule deer, and antelope indicated a sharp rise (more than 190%) in hunter kills from 1964 to 1973. Harvest of upland game such as pheasant dropped by one-half, while harvest of grouse increased 64%. Significant impacts on fish were an initial decline in rainbow trout due to temperature rise in the water and a decline in carp. The report recommends establishment of additional wildlife management areas adjacent to the lake in order to increase waterfowl and upland game and offset losses due to harvesting by hunters. (Arnold-NC)
W79-05717

FISHERIES ISSUES RELATED TO WATER DEVELOPMENT IN THE SACRAMENTO-SAN JOAQUIN ESTUARY, CALIFORNIA,
California State Dept. of Fish and Game, Stock-

ton.
H. K. Chadwick.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, Illinois. p 409-414, 1978. 3 fig, 11 ref.

Descriptors: *Environmental effects, *Engineering, *Intakes, Water demand, Entrainment, Fisheries, Estuarine fisheries, California, *Impingement.

This investigation indicates that the most effective ways to mitigate the adverse effects of water development in the Sacramento-San Joaquin estuary are to build an isolated channel to move the point of diversion from the south Delta to the Sacramento River and to release water down the Sacramento River and from the channel in amounts sufficient to provide the necessary degree of salinity repulsion. Fish screen development progress is discussed in light of a finding that entrainment of striped bass in water diversions has been responsible for population reduction. (See also W79-05754) (Chilton-ORNL)
W79-05789

GROWTH EFFECTS OF MAJOR LAND USE PROJECTS (WASTEWATER FACILITIES), VOLUME I: MODEL SPECIFICATION AND CAUSAL ANALYSIS,
Abcor, Inc., Wilmington, MA. Walden Div.
P. H. Guldberg, R. B. D'Agostino, and R. D. Cunningham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 410, Price codes: A12 in paper copy, A01 in microfiche. Report No. EPA-450/3-78-014a, March 1978. 254 p, 19 fig, 49 tab, 426 ref, 4 append. 68-02-2594.

Descriptors: *Waste water, *Treatment facilities, *Environmental impact, *Air pollution, *Land use, Models, Mathematical models, Statistical models, Least squares method, Statistical methods, Statistics, Cities, Planning, Analytical techniques.

The induced secondary growth effects of major waste water projects were examined with the goal of developing methodologies for predicting the total air pollution emissions which result from the construction and operation of major land use projects. The emissions are from residential complexes at the end of and along new sewer lines; service-oriented land uses relating to residential development, such as commercial, industrial, office, and government; and motor vehicles used as transportation between development areas. Data were collected nationwide from 40 case study waste water projects. This document is concerned with three of the four major phases of the study: (1) definition of basic concepts and initial model specification; (2) data collection; and (3) causal analysis of the land use model using path analysis. A theoretical model was developed representing the total land use in the drainage basin of a waste water collection and treatment system ten years after its construction. The causal analysis of induced land development involved the use of path analysis and two basic statistical techniques: two-stage least squares and stepwise ordinary least squares. The final models of land use development show strong statistical relationship between the variables representing nine categories of total land use and other model variables representing induced and non-induced land use growth processes. It was noted that treatment plant capacity was not found to be an important causal factor. (Davison-IPA)
W79-05866

7. RESOURCES DATA

7A. Network Design

A COMPENDIUM OF LAKE AND RESERVOIR DATA COLLECTED BY THE NATIONAL EUTROPHICATION SURVEY IN THE CENTRAL UNITED STATES.
For primary bibliographic entry see Field 5C.
W79-05732

A COMPENDIUM OF LAKE AND RESERVOIR DATA COMPILED BY THE NATIONAL EUTROPHICATION SURVEY IN THE WESTERN UNITED STATES.
For primary bibliographic entry see Field 5C.
W79-05733

WATER QUALITY: STREAMS AND PONDS ON SELECTED TEST AREAS ON EGLIN AIR FORCE BASE, FLORIDA,
Air Force Armament Lab., Eglin, AFB, FL.
For primary bibliographic entry see Field 5C.
W79-05839

CHEMICAL, PHYSICAL, BIOCHEMICAL, AND BACTERIOLOGICAL CHARACTERISTICS AT SELECTED STREAM SITES IN PUERTO RICO, 1967-77,
Geological Survey, San Juan, PR. Water Resources Div.
F. Quinones-Marquez, P. Vazquez, and R. Pena-Cortes.
Geological Survey open-file report 78-445, November 1978. 145 p, 1 fig, 1 tab, 12 ref. append.

Descriptors: *Water quality, *Water pollution sources, *Path of pollutants, *Puerto Rico, *Streams, Water analysis, Sampling, Sites, Chemical analysis, Chemical properties, Physical properties, Network design.

In 1969, the Caribbean District of the U.S. Geological Survey, in cooperation with the Commonwealth of Puerto Rico, initiated the operation of a network to monitor some parameters indicative of water-quality changes at selected stream sites. In 1974, at the request of the Environmental Quality Board of Puerto Rico, the network was modified to conform with the Environmental Protection Agency National Water Quality Surveillance System. The purpose of the present network is to monitor changes in water quality between the upstream and downstream stations. The expanded network consisted of 58 stations. During 1976, five had been discontinued. One other was added late in 1976. Most of the stations in the original network have been maintained, thus providing some degree of continuity. The monitoring stations used in this report are shown on a map and listed in a table. The results of the network operation are summarized for the period July 1976 to August 1977. (Woodard-USGS)
W79-05967

NATIONAL WATER DATA COORDINATION IN THE UNITED STATES,
Geological Survey, Reston, VA. Water Resources Div.
F. P. Kapinos, R. H. Langford, and A. I. Johnson.
Hydrological Sciences Bulletin, Vol 23, No 2, p 193-202, 1978. 5 fig.

Descriptors: *Water resources, *Data collections, *Network design, *Methodology, Hydrologic data, Surface waters, Groundwater, Water quality, Planning, Evaluation, Analytical techniques, Testing procedures, Information retrieval, *Office of Water Data Coordination(OWDC), Federal agencies, Non-Federal agencies.

The Office of Water Data Coordination (OWDC), established in 1964 within the Department of the Interior's Geological Survey, is charged with lead-agency responsibility for coordinating Federal water-data collection activities, cataloging all water-data acquisition activities, and developing a national plan to acquire needed water data. A 21-volume 'Catalog of Information on Water Data' has been released and the data-collection activities of all Federal agencies are coordinated through an annually-released Federal Plan. The National Water Data Network, initially developed in 1966, has been further refined through a coordinated effort that has provided a nationally-consistent set of river-basin maps for use in water-resources planning and assessment and in organizing and disseminating water-resources information. Following recommendations set forth by Federal and non-Federal advisory committees, the OWDC embarked on a procedure for designation of standards for water-data acquisition. The initial work, which began in 1970, resulted in publication of an interagency preliminary report. That report presently is being updated and expanded in cooperation with 25 Federal agencies and with technical standards-setting organizations and other non-Federal agencies. This activity will result in improved comparability, reliability, and usability of the data, and in improved efficiencies in generating, storing, processing, and disseminating water information. (Woodard-USGS)
W79-05971

7B. Data Acquisition

ESTIMATION OF SNOW TEMPERATURE AND MEAN CRYSTAL RADIUS FROM REMOTE MULTISPECTRAL PASSIVE MICROWAVE MEASUREMENTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2C.
W79-05518

CONCENTRATION AND SIZE OF GRAVEL IN RELATION TO NEUTRON MOISTURE AND DENSITY PROBE CALIBRATION,
International Inst. of Tropical Agriculture Ibadan (Nigeria).
R. Lal.
Soil Science, Vol. 127, No. 1, p 41-50, January 1979. 4 fig, 6 tab, 22 ref.

Descriptors: *Nuclear meters, *Gravels, *Moisture content, Soil moisture, Instrumentation, Calibrations, Soil density, Soil texture, Particle size, Regression analysis, Statistical methods, Sands, Heterogeneity, Beaches, Neutron count ratio, Beach sand.

The effects of 4 gravel concentrations (0, 20, 40, and 60% by weight) and 3 gravel size fractions (4-8 mm, 8-15 mm, and 15-40 mm) on the calibration of a neutron moisture meter and density probe were investigated for a beach sand and a clayey tropical Alfisol (Oxic Paleustalf). The slope of the regression line of the calibration curve relating neutron count ratio with volumetric moisture content of gravel-free sand was statistically significantly different from that of three gravel-sand mixtures. The calibration curve of 3 gravel-sand mixtures was statistically identical. For the gravel-soil mixtures, the slope of the calibration curve generally decreased with increased gravel concentration. The statistical comparison of the regression lines for the 4-8 mm gravel size fraction indicated that the slope coefficient of the calibration curve of only 60% gravel-soil mixture was significantly lower than that of 0, 20, and 40 gravel percentages. For the 8-15 mm gravel size fraction, the slopes of the regression lines of 40 and 60% gravel-soil mixtures were similar and significantly lower than those of 0 and 20% gravel concentrations. Gravel size had no effect on the calibration curve in the gravel-sand mixtures. (Visocky-ISWS)
W79-05530

EASTERN-WESTERN ARCTIC SEA ICE ANALYSES,
Fleet Weather Facility, Suitland, MD.
For primary bibliographic entry see Field 2C.
W79-05613

LAKE ERIE ICE: WINTER 1975-76,
National Oceanic and Atmospheric Administration, Rockville, MD. Environmental Science Information Center.
For primary bibliographic entry see Field 2C.
W79-05615

APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY,
Norges Vassdrags- og Elektrisitetsvensen, Oslo.
H. A. Odegaard, and G. Ostrem.
Available from the National Technical Information

ervice, Springfield, VA 22161 as N78-10029, rice codes: A05 in paper copy, A01 in microfiche. inal Report, LANDSAT-2 Contract 29020, Feb- uary 1, 1977. 62 p, 34 fig, 12 ref. NASA 29020.

escriptors: *Remote sensing, *Snow cover, Runoff, *Melt water, Satellites(Artificial), Water esources, Mapping, Watersheds(Basins), Moun- ains, Data processing, Analytical techniques, now, Physical properties, Rivers, ischarge(Water), Snow surveys, Glaciers, Norway.

he project reported herein dealt with snow cover apping from satellite imagery to produce data for ater resources management. The extent of snow over within a given high mountain watershed as bserved in the spring was related directly to the otal volume of melt water run-off. Space-acquired ata are valuable if they are received by the user ithin a few days so that an operational use of the ata can be possible. A simple, quick, and easily nderstood procedure was recommended: snow- overed areas are directly determined on photo- raphic enlargements of LANDSAT images, pref- rably overlaid on a map of the catchment area. he area extent of snow cover is determined imply by counting squares or grid points. A dia- ram showing the relation between snow cover nd subsequent melt water runoff was established or several given catchment areas, but it seems that he same curve can be used also for other high- ountain drainage basins. The curve can be used irectly for runoff forecasts as soon as snowmelt as started. A special method was developed for lacierized watersheds, based upon the height of he transient snowline. (Sims-ISWS)
V79-05617

COMPARISON OF 2.8- AND 21-CM MICRO- WAVE RADIOMETER OBSERVATIONS OVER OILS WITH EMISSION MODEL CALCULA- IONS,
egis Coll. Research Center, Weston, MA.
V. J. Burke, T. Schmugge, and J. F. Paris.
ournal of Geophysical Research, Vol. 84, No. C1, 287-294, January 20, 1979. 7 fig, 1 tab, 12 ref.

escriptors: *Remote sensing, *Model studies, Soil moisture, Mathematical models, Microwaves, adiation, Aircraft, Soil water, Temperature, Data rocessing, Analytical techniques, Correlation nalysis, Soils.

n airborne experiment was conducted under NASA auspices to test the feasibility of detecting oil moisture by microwave remote sensing tech- iques over agricultural fields near Phoenix, AZ., t midday of April 5, 1974 and at dawn of the ollowing day. Extensive ground data were ob- ained from 96 bare, 16 hectare fields. Observations nade using a scanning (2.8 cm) and a nonscanning 21 cm) radiometer were compared with the pre- lictions of a radiative transfer emission model. It vas shown that (1) the emitted intensity at both vavelengths correlates best with the near surface noisture, (2) Surface roughness more strongly af- ects the degree polarization than the emitted in- ensity, (3) the slope of the intensity-moisture urves decreases in going from day to dawn, and 4) increased near surface moisture at dawn is haracterized by increased polarization of emis- ions. The results of the experiment indicated that nicrowave techniques can be used to observe the istory of the near surface moisture. The subsur- ace history must be inferred from soil physics nodels which use microwave results as boundary onditions. (Sims-ISWS)
V79-05633

DESIGN OF A RELIABLE, INEXPENSIVE RE- CORDING RAIN GAGE WHICH UTILIZES SOLID-STATE MEMORY,
Kentucky Water Resources Research Inst., Lex- ngton.
S. A. Dyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 536, Price codes: A04 in paper copy, A01 in microfiche. Research Report No. 119, 1979. 46 p, 15 fig, 6 tab, 9 ref. OWRT A-072-KY(1). 14-34-0001-7038 (1977), 14-34-0001-8019 (1978).

Descriptors: Instrumentation, *Rain gages, Micro- processors, Remote control.

This report describes a microprocessor-controlled remote recording rain gage which is capable of unattended operation for periods of greater than a month that costs less than $400.00. The laboratory prototype uses a tipping bucket to collect precipi- tation in 0.01-inch increments. The time of the bucket tip is stored, using an offset binary format, in solid-state memory. A complete description of the gage hardware is presented along with an outline of the software used. Many improvements to the basic gage design will be possible in the near future as low-power CMOS microprocessors with advanced architectures and high-density magnetic bubble memory become readily available. A reli- able and cost-effective gage is suggested to include a tipping bucket, a CMOS time base, a CMOS version of an 8748-like or 6802-like microproces- sor, and a 256 kilobit magnetic-bubble memory. W79-05793

APPLICATIONS OF REMOTE SENSING TO WATER RESOURCES,
ECOsystems International, Inc., Gambrills, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-13509, Price codes: A04 in paper copy, A01 in microfiche. NASA Contract Report 150467, December 1977. 50 p, 25 fig, 8 tab. NASA NAS8-32408.

Descriptors: *Remote sensing, *Water resources, *Water demand, Satellites(Artificial), Mapping, Watersheds(Basins), Floods, Wetlands, Precipitation(Atmospheric), Snow cover, Irriga- tion, Reservoirs, Storage, Water quality, Soil mois- ture, Water treatment, Cooling water, Water supply, Data management.

In FY-77, the Marshall Space Flight Center (MSFC) Data Management Program activities largely centered around the analyses of selected far-term (1985 and beyond) Office of Applications (OA) objectives, with the intent of determining if significant data-related problems would be encoun- tered and to develop alternative solutions to any potential problems. One far-term OA objective selected for analysis was Water Availability Fore- casting. MSFC scheduled a brief overview in FY- 77 of the objective--primarily a fact-finding study to allow MSFC Data Management personnel to gain adequate background information to perform subsequent data system analyses. ECOsystems In- ternational, Incorporated, provided a significant part of this background material. This report in- cluded discussions on some of the larger problems currently encountered in water measurement, the potential users of water availability forecasts, pro- jected demands of users, current sensing accura- cies, required parameter monitoring, status of fore- casting modeling, and some measurement accura- cies likely to be achievable by 1980 and 1990. (Sims-ISWS)
W79-05840

AN AUTOMATIC SEQUENTIAL RAIN SAM- PLER,
Laboratoire de Chimie Inorganique et Nucleaire, Chemin du Cyclotron, Louvain (Belgium).
C. Ronneau, J. Cara, J. L. Navarre, and P. Priest.
Water, Air, and Soil Pollution, Vol. 9, No. 2, p 171-176, February 1978. 2 fig, 1 tab, 7 ref.

Descriptors: *Rain gages, *Rainfall intensity, *In- strumentation, *Water pollution sources, Measure- ment, Sampling, Water quality, Air pollution, Automation, Rain water, Foreign research, Precipitation(Atmospheric).

A sequential rain sampler was described. The sam- pler was designed to operate automatically and unattended in remote areas. Precipitation water is sampled sequentially in order to study the evolu- tion of contaminant concentrations as a function of rain intensities and duration. A few preliminary results were presented; they were related to rain samples collected in a semi-rural area. Rain is collected by two successive funnels and sampled into polyethylene satchels slipped into polyethyl- ene vials. The sampling sequence is provided by the tilting of successive vials; the tilting occurs when the weight of water sampled is sufficient to balance the counterweights fixed on the vials. As a general rule, there is a net decrease in the concen- tration of pollutants in water during a precipita- tion; the reduction factor can be as high as 20 for a 15 minute rain. The rate of diminution generally adopts an exponential form as a function of the quantity of water sequentially sampled. (Hum- phreys-ISWS)
W79-05847

PERSISTENCE AND OROGRAPHIC MODU- LATION OF MESOSCALE PRECIPITATION AREAS IN A POTENTIALLY UNSTABLE WARM SECTOR,
Royal Signals and Radar Establishment, Malvern (England). Radar Research Lab.
For primary bibliographic entry see Field 2B.
W79-05855

PROCEEDINGS FOR GATHERING GROUND TRUTH INFORMATION FOR A SUPERVISED APPROACH TO A COMPUTER-IMPLEMENT- ED LAND COVER CLASSIFICATION OF LANDSAT-ACQUIRED MULTISPECTRAL SCANNER DATA,
National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center.
A. T. Joyce.
NASA Reference Publication 1015, January 1978. 48 p, 4 fig, 6 ref, 6 append.

Descriptors: *Remote sensing, *Classification, *Mississippi, *Computers, Photography, Aerial photography, Maps, Forests, Vegetation, Training, Personnel, Sites, Programming languages, Land use, Land cover, Ground truth data, LANDSAT.

Procedures for gathering ground truth information for a supervised approach to a computer-imple- mented land cover classification of Landsat-ac- quired multispectral scanner data were provided in a step-by-step manner. Criteria for determining size, number, uniformity, and predominant land cover of training sample sites were established. Suggestions were made for the organization and orientation of field team personnel, the procedures used in the field, and the format of the forms to be used. Estimates were made of the probable expend- itures in time and costs. Examples of ground truth forms and definitions and criteria of major land cover categories were provided in appendixes. (Froehlich-ISWS)
W79-05859

QUANTITATIVE ANALYSIS OF AIRCRAFT MULTISPECTRAL-SCANNER DATA AND MAPPING OF WATER-QUALITY PARAM- ETERS IN THE JAMES RIVER IN VIRGINIA,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
R. W. Johnson, and G. S. Bahn.
NASA Technical Paper 1021, December 1977. 31 p, 11 fig, 6 tab, 11 ref.

Descriptors: *Virginia, *Remote sensing, *Water quality, Mapping, Rivers, Analysis, Sediments, Sta- tistical methods, Photography, Aerial photogra- phy, Suspended solids, Nutrients, Water pollution, Equations, Chlorophyll, Measurement, Nitrites, Data collections, *James River(VA).

Statistical analysis techniques were applied to de- velop quantitative relationships between in situ river measurements and the remotely sensed data that were obtained over the James River in Virgin- ia on May 28, 1974. The remotely sensed data were collected with a multispectral scanner and with photographs taken from an aircraft platform. Con- centration differences among water-quality param- eters such as suspended sediment, chlorophyll a, and nutrients indicated significant spectral vari- ations. Calibrated equations from the multiple re- gression analysis were used to develop maps that

indicated the quantitative distributions of water-quality parameters and the dispersion characteristics of a pollutant plume entering the turbid river system. Results from further analyses that use only three preselected multispectral-scanner bands of data indicated that regression coefficients and standard error of estimate were not appreciably degraded compared with results from the 10-band analysis. (Froehlich-ISWS)
W79-05862

REGIONAL MEAN BOWEN RATIOS DEDUCED FROM DIURNAL CHANGES OF TEMPERATURE AND HUMIDITY,
Edinburgh Univ. (Scotland). Dept. of Meteorology.
For primary bibliographic entry see Field 2A.
W79-05883

FLIGHT PATH CURVATURE DISTORTION IN SIDE-LOOKING AIRBORNE RADAR IMAGERY,
Geological Survey, Tacoma, WA. Water Resources Div.
C. H. Ling, L. A. Rasmussen, and W. J. Campbell.
Photogrammetric Engineering and Remote Sensing, Vol. 44, No. 10, p 1255-1260, October 1978. 2 fig, 2 tab, 2 ref.

Descriptors: *Remote sensing, *Mapping, *Aerial photography, *Analytical techniques, Navigation, Radar, Aircraft, *Terrain analysis.

Although several of the errors in obtaining SLAR (Side-Looking Airborne Radar) imagery can be substantially corrected electronically, the error due to the curvature of the flight path cannot be. For a 130 km flight over the Alaskan coast this error is estimated to be as much as 2.8 km. A correction method is proposed that requires only a few points identifiable both on the image and on the map. It employs a quasi-circular piecewise function passing through these identifiable points, which enables the image coordinates of any other points to be rapidly converted to map coordinates. Synthetic test data and the Alaskan imagery indicate that the error remaining after applying this curvature correction is about 0.2 km. (Woodard-USGS)
W79-05973

CONCENTRATIONS OF METALS IN VERY SMALL VOLUMES OF SOIL SOLUTION,
Geological Survey, Denver, CO. Geological Div.
T. Hinkley.
Nature, Vol. 277, p 444-446, 8 February 1979. 1 fig, 4 tab, 17 ref.

Descriptors: *Soil analysis, *Soil water, *Chemical analysis, *Metals, *Analytical techniques, Mass spectrometry, Stable isotopes, Soil-water-plant relationships, Chemical properties, *Soil solutions.

A new method of sampling very small amounts of soil solution (0.3 g) shows that soil solutions contain high concentrations and unusual proportion of metals. In the soils studied, the solution is close in both metal proportions and total metal mass to what may be taken up annually by the growth of plants at the sites sampled. Composition of soil solution varies seasonally and with depth in soil. (Woodard-USGS)
W79-05976

REMOTE-SENSING AND SUBSURFACE DEFINITION OF FACIES AND STRUCTURE RELATED TO URANIUM DEPOSITS, POWDER RIVER BASIN, WYOMING,
Geological Survey, Denver, CO. Geologic Div.
G. L. Raines, T. W. Offield, and E. S. Santos.
Economic Geology, Vol. 73, p 1706-1723, 1978. 13 fig, 17 ref.

Descriptors: *Remote sensing, *Satellites(Artificial), *Infrared radiation, *Uranium radioisotopes, *Mineralogy, Subsurface investigations, Wyoming, Fluvial sediments, Groundwater movement, Geochemistry, Water chemistry, *Uranium deposition, *Landsat images, *Southern Powder River basin(Wyo).

Computer-enhanced Landsat images of the southern Powder River basin have been used to define facies and linear structural features within the Wasatch Formation. The facies distribution is detectable primarily because of a relation of vegetation density and type to the local substrate. The surface indications of facies are confirmed by sandstone/mudstone ratios determined from logs of abundant exploration drill holes. These newly defined geologic features are spatially related to known uranium mineral occurrences and are believed to be related to mineralization in the following ways. (1) Major uranium occurrences are virtually restricted to an intermediate grain-size facies of the Wasatch, probably marking the axial zone of the depositional basin. (2) The axial zone is also marked by a change from one structural lineament domain to another, and the structures may have influenced details of fluvial-system patterns and sedimentation and (subsequently) the flow of uranium-bearing ground water. (3) A recently active linear structure may mark the current basin axis; it appears to have some relationship both to ground-water chemistry and the distribution of uranium occurrences, suggesting structural influence on relatively modern ground-water transport and uranium deposition. (Woodard-USGS)
W79-05977

7C. Evaluation, Processing and Publication

PROCEEDINGS OF THE FIRST MEMBERSHIP CONFERENCE OF THE NATIONAL WATER DATA EXCHANGE, MAY 9-11, 1978, DENVER, COLORADO,
Geological Survey, Reston, VA. Water Resources Div.
B. M. Myers, and J. M. Nokes.
Geological Survey open-file report 79-206, 1979. 217 p, 3 append.

Descriptors: *Information exchange, *Hydrologic data, *Conferences, *Data processing, *Computer programs, Data storage and retrieval, Indexing, *National Water Data Exchange(NAWDEX).

This report contains the proceedings of the first membership conference of the National Water Data Exchange (NAWDEX). The purpose of the conference was to acquaint participants in the NAWDEX program with the systems, data resources, and services available throughout the membership, to establish improved personal relationships within the membership, and to serve as a forum for the exchange of ideas and expertise on matters relating to improving the operation of NAWDEX and identifying the needs of the water-data community. Sixteen papers were presented at the conference which describe data systems of member organizations, needs of the data community, and programs of national interest. These papers are published in their entirety in this proceedings volume. Four working panels were also conducted dealing with (1) Program Administration, Management, and Coordination; (2) Recommended Standards for the Handling and Exchange of Water Data; (3) Water Data Indexing and Technical Systems Development; and (4) Request, Response and Service Activities. The reports and conclusions of these panels are included also. (Woodard-USGS)
W79-05585

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE BOULDER--FORT COLLINS--GREELEY AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
P. A. Schneider, Jr., and D. E. Hillier.
Availability: OFSS, USGS Box 25425, Dep. Fed. Ctr. Denver, CO., 80225, Paper copy $12.00, microfiche $4.00. Geological Survey open-file report 78-567, July 1978. 55 p, 2 fig, 1 plate, 2 tab, 6 ref.

Descriptors: *Hydrologic data, *Water tabl aquifers, *Well data, *Water levels, *Water qual ity, Data collections, Water wells, Chemical analy sis, Sites, Maps, Colorado, *Boulder--Fort Collins-Greeley area.

As part of the U.S. Geological Survey's investiga tions of the hydrology and geology in the Fron Range Urban Corridor of Colorado, hydrologi data relating to water-table aquifers were compile during 1976-77. These data consisting of records o 446 wells and chemical analyses of water from 20 wells in the Boulder--Fort Collins--Greeley area are presented in tabular form. The well-data table contain records that were collected during 1976 77. The chemical analysis tables contain record that were collected during 1956-77. State and loca officials in the Boulder--Fort Collins--Greeley are may find these data useful in planning for residen tial, commercial, and industrial developmen (Woodard-USGS)
W79-05594

THE MISSISSIPPI RIVER VALLEY ALLU VIAL AQUIFER IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resource Div.
G. J. Dalsin.
Geological Survey Water-Resources Investigation 78-106 (open-file report), 1978. 2 sheets, 13 fig, tab, 21 ref.

Descriptors: *Groundwater resources, *Aquif characteristics, *Water yield, *Hydrogeolog *Water quality, Water wells, Maps, Hydrolog data, Water utilization, Irrigation, Industrial wate Water supply, Water demand, Groundwater avai ability, Mississippi, *Mississippi River valley all vial aquifer.

The Mississippi River valley alluvial aquifer, Quaternary age, contains freshwater in an area 7,000 sq mi adjacent to the Mississippi River northwestern Mississippi, and in a 500 sq mi irreg lar area in southwestern Mississippi. It is the hig est yielding aquifer in Mississippi with individu well yields as high as 5,000 gal/min. Major we producing from the aquifer range in depth from to 260 ft and are commonly screened in the coar gravel at the base of the aquifer. Water levels wells are generally between 5 and 30 feet belo land surface, except near points of heavy pumpin Water from the alluvial aquifer is a hard, calciu bicarbonate type containing excessive iron in mo places. In 1975, 745 Mgal/d, mostly for irrigatio were withdrawn from the alluvial aquifer. In t 7,000 sq mi area in northwestern Mississippi, t alluvial aquifer has been estimated to be capable yielding over 1,700 Mgal/d, not including the 5 sq mi area in southwestern Mississippi. (Woodar USGS)
W79-05597

WATER RESOURCES DATA FOR WYOMIN WATER YEAR 1977--VOLUME 1. MISSOU RIVER BASIN,
Geological Survey Cheyenne, WY. Water R sources Div.
Available from the National Technical Informati Service, Springfield, VA 22161 as PB-293 4 Price codes: A99 in paper copy, A01 in microfic Geological Survey Water-Data Report WY-77 October 1978. 616 p, 9 fig.

Descriptors: *Wyoming, *Hydrologic data, *S face waters, *Groundwater, *Water quali Gaging stations, Streamflow, Flow rates, Sedim transport, Water analysis, Water temperatu Chemical analysis, Lakes, Reservoirs, Water we Water levels, Data collections, Sites, *Misso River basin.

Water resources data for the 1977 water year Wyoming consist of records of stage, dischar and water quality of streams; stage, contents, water quality of lakes and reservoirs; and wa levels and water quality of wells. This report, two volumes, contains discharge records for gaging stations; stage only records for 1 lake; st and contents for 16 lakes and reservoirs; wa

uality for 117 gaging stations, 41 ungaged sta-ions, 2 reservoirs, and 247 wells and springs; and vater levels for 45 observation wells. Also includ-d are 101 crest-stage partial-record stations. Addi-ional water data were collected at various sites, ot part of the systematic data-collection program, nd are published as miscellaneous measurements nd analyses. These data represent that part of the Jational Water Data System operated by the U.S. Geological Survey and cooperating State and Fed-ral agencies in Wyoming. (Woodard-USGS)
V79-05598

VATER RESOURCES DATA FOR WYOMING, VATER YEAR 1977--VOLUME 2. GREEN RIVER BASIN, BEAR RIVER BASIN, SNAKE RIVER BASIN,
Geological Survey, Cheyenne, WY. Water Re-ources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 494, Price codes: A21 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WY-77-2, December 1978. 484 p, 6 fig.

Descriptors: *Wyoming, *Hydrologic data, *Sur-ace waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment ransport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Green River asin, *Bear River Basin, *Snake River basin.

Water resources data for the 1977 water year for Wyoming consist of records of stage, discharge, nd water quality of streams; stage, contents, and vater quality of lakes and reservoirs; and water evels and water quality of wells. This report, in wo volumes, contains discharge records for 214 gaging stations; stage only records for 1 lake; stage nd contents for 16 lakes and reservoirs, and 247 wells and springs; and water levels for 45 observa-ion wells. Also included are 101 crest-stage par-ial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as mis-cellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Wy-oming. (Woodard-USGS)
W79-05599

MAP SHOWING DRAINAGE AREAS, COLUM-BIA QUADRANGLE, CONNECTICUT,
Geological Survey, Hartford, CT. Water Re-sources Div.
M. P. Thomas.
Availability: Branch of Distribution, USGS 1200 S. Eads St., Arlington, VA. 22202 price $0.75. Geological Survey Miscellaneous Field Studies Map MF-941-A, 1978. 1 sheet.

Descriptors: *Maps, *Drainage area, *Connecticut, Streamflow, Sampling, Sites, Gaging stations, Water quality, Topography, *Columbia quadran-gle.

A map, scale 1:24,000, shows drainage areas for the Columbia quadrangle, Connecticut. Also included are generalized directions of streamflow and sites for stream gages, surface-water sampling, outlets of surface-water impoundments, and mouths of tribu-tary streams. (Woodard-USGS)
W79-05600

MAP SHOWING DRAINAGE AREAS, NOR-FOLK QUADRANGLE, CONNECTICUT,
Geological Survey, Hartford, CT. Water Re-sources Div.
M. P. Thomas, and R. L. White.
Availability: Branch of Distribution, USGS, 1200 S. Eads St., Arlington, VA. 22202 price $0.75. Geological Survey Miscellaneous Field Studies Map MF-942-A, 1978. 1 sheet.

Descriptors: *Maps, *Drainage area, *Connecticut, Streamflow, Sampling, Sites, Gaging stations, Water quality, Topography, *Norfolk quadrangle.

A map, scale 1:24,000, shows drainage areas for the Norfolk quadrangle, Connecticut. Also included are generalized directions of streamflow and sites for stream gages, surface-water sampling, outlets of surface-water impoundments, and mouths of tribu-tary streams. (Woodard-USGS)
W79-05601

MAP SHOWING DRAINAGE AREAS, NEW BRITAIN QUADRANGLE, CONNECTICUT,
Geological Survey, Hartford, CT. Water Re-sources Div.
M. P. Thomas, and R. L. Melvin.
Availability: Branch of Distribution, USGS, 1200 S. Eads St., Arlington, VA. 22202 Price $0.75. Geological Survey Miscellaneous Field Studies Map MF-523-D, 1978. 1 sheet.

Descriptors: *Maps, *Dranage area, *Connecticut, Streamflow, Sampling, Sites, Gaging stations, Water quality, Topography, *New Britain quad-rangle.

A map, scale 1:24,000 shows drainage areas for the New Britain quadrangle, Connecticut. Also includ-ed are generalized directions of streamflow and sites for stream gages, surface-water sampling, out-lets of surface-water impoundments, and mouths of tributary streams. (Woodard-USGS)
W79-05602

MAP SHOWING DRAINAGE AREAS, COL-LINSVILLE QUADRANGLE, CONNECTICUT,
Geological Survey, Hartford, CT. Water Re-sources Div.
M. P. Thomas, and P. A. Adams.
Availability: Branch of Distribution, USGS, 1200 S. Eads St., Arlington, VA. 22202 Price $0.75 Geological Survey Miscellaneous Field Studies Map MF-654-B, 1978. 1 sheet.

Descriptors: *Maps, *Drainage area, *Connecticut, Streamflow, Sampling, Sites, Gaging stations, Water quality, Topography, *Collinsville quadran-gle.

A map, scale 1:24,000, shows drainage areas for the Collinsville quadrangle, Connecticut. Also includ-ed are generalized directions of streamflow and sites for stream gages, surface-water sampling, out-lets of surface-water impoundments, and mouths of tributary streams. (Woodard-USGS)
W79-05603

RECORD OF WELLS IN THE FLORIDAN AQUIFER IN DADE AND MONROE COUN-TIES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Re-sources Div.
T. R. Beaven, and F. W. Meyer.
Geological Survey open-file report 78-881, Octo-ber 1978. 30 p, 5 fig, 9 tab, 9 ref.

Descriptors: *Well data, *Aquifers, *Water levels, *Water quality, *Potentiometric level, Water analy-sis, Chemical analysis, Inorganic compounds, Dis-solved solids, Hardness(Water), Trace elements, Hydrogen sulfide, *Florida, *Dade County(FL), *Monroe County, *Floridan aquifer.

The utilization of the Floridan aquifer as a source of potable water has increased. The use of the Floridan aquifer for subsurface storage of fresh-water, and as an industrial water supply in Dade and Monroe Counties, is being considered by water management authorities and some industries. Information on locations, depths, casings, and year drilled for 67 wells that penetrate the Floridan aquifer in Dade and Monroe Counties is presented to assist in planning future uses of the Floridan. Chloride concentrations in water from wells ending in the Floridan aquifer in Dade County ranged from 1,200 to 9,000 milligrams per liter. In Monroe County the chloride concentrations ranged from 1,600 to 20,000 milligrams per liter. Water levels were measured in selected wells to determine the altitude of the potentiometric sur-face. The measurements indicate that the 40-foot potentiometric line extends from southern Dade County to the upper Florida Keys. (Woodard-USGS)
W79-05606

WATER RESOURCES OF SOUTH-CENTRAL IOWA,
Geological Survey, Iowa City, IA. Water Re-sources Div.
J. W. Cagle, and A. J. Heinitz.
Iowa Geological Survey Water Atlas No. 5, 1978. 97 p, 59 fig, 14 tab, 36 ref.

Descriptors: *Available water, *Surface waters, *Groundwater resources, *Water quality, *Iowa, Water supply, Water utilization, Municipal water, Industrial water, Domestic water, Potable water, Streamflow, Regulated flow, Water storage, Res-ervoirs, Lakes, Hydrologic data, Maps, *South-central Iowa.

Information is presented on the availability, qual-ity, and use of ground and surface water in an eleven-county area in south-central Iowa. The best sources of water supply in the area are Red Rock and Rathbun Lakes and other impoundments. The Des Moines River is the only stream in the area that can supply adequate amounts of water without storage. Yields of as much as 1,000 gallons per minute (gal/min) are available to individual wells from the deeply-buried Cambrian-Ordovician aquifer. Yields of 150 to 500 gal/min can be ob-tained from the alluvial aquifer in the valleys of the Des Moines and Skunk Rivers; yields from the alluvium in tributary valleys range from 25 to 100 gal/min. The Pennsylvanian, Mississippian, and Devonian aquifers, although capable of furnishing 100 gal/min or more locally, generally yield only 3 to 25 gal/min. The deep drift and buried-channel aquifers will yield as much as 25 gal/min at places and occasionally as much as 60 gal/min. The chemical quality of surface water is suitable for most purposes; dissolved solids generally are less than 500 milligrams per liter (mg/L). Water with less than 500 mg/L dissolved solids is available from parts of all aquifers except the Devonian but only the alluvial and shallow drift aquifers contain water with less than 500 mg/L in most parts of the aquifer. Water withdrawals averaged about 26 mil-lion gallons per day in 1972-73; ground water accounted for 66 percent of the total withdrawals and surface water sources made up 34 percent. (Woodard-USGS)
W79-05609

THE USE OF SNOWCOVERED AREA IN RUNOFF FORECASTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2C.
W79-05611

THE TRANSMISSIVITY ITERATIVE CALCU-LATION ROUTINE--THEORY AND NUMERI-CAL IMPLEMENTATION,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resources Dept.
D. B. Cearlock, K. L. Kipp, and D. R. Friedricks.
Available from the National Technical Information Service, Springfield, VA 22161 as BNWL-1706, Price codes: A06 in paper copy, A01 in microfiche. Report BNWL-1706, December 1972, Revised May 1975. 111 p, 55 fig, 11 tab, 20 ref, 2 append. AT(45-1)-2130.

Descriptors: *Transmissivity, *Theoretical analy-sis, *Aquifers, *Numerical analysis, *Computer models, Mathematical models, Hydraulic conduc-tivity, Heterogeneity, Computer programs, Flow, Dupuit-Forchheimer theory, Distribution, Data processing, Data collections, Aquifer characteris-tics, Model studies, Equations, *Boussinesq equa-tion, Flowlines, Sensitivity, Digitizer.

A computer routine, the Transmissivity Iterative Routine (TIR), has been developed for calculating the hydraulic conductivity distribution in highly heterogeneous aquifers where characterization by field measurement methods alone would be prohib-itive in cost. The method is based on the numerical

integration of the Boussinesq equation for the hydraulic conductivity along instantaneous streamtubes of flow. The routine yields the two-dimensional distribution of hydraulic conductivity averaged over the aquifer thickness. The program was written for an interactive computer system with a light-pen, CRT display, and graphical digitizer, which allow rapid reinterpretation and evaluation of groundwater contours. The TIR was implemented on the Hanford unconfined aquifer, and an approximation to the vertically averaged hydraulic conductivity distribution was calculated. Preliminary verification of this distribution, accomplished by simulating the groundwater potential changes as functions of time for the period 1968 through 1973, was surprisingly good, considering the estimated accuracy of the input data, for those regions where enough data were available. The tests and verification calculations performed demonstrated the usefulness of the TIR method for: (1) generating hydraulic conductivity distributions for heterogeneous aquifers; (2) systematically evaluating the adequacy and reliability of existing data; and (3) specifying the type, quantity and location of additional data that would be required to provide the desired accuracy and resolution of aquifer conductivity. (Visocky-ISWS)
W79-05614

ANALYSIS AND DISSEMINATION OF WATER RESOURCES INFORMATION,
South Dakota State Univ., Brookings. Water Resources Research Inst.
M. L. Horton, J. L. Wiersma, and C. G. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 540, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, February 1979. 43 p, 10 fig, 4 ref, append. OWRT A-050-SDAK(1). 14-31-0001-5042.

Descriptors: Data processing, Computer programs, Spatial distribution.

A computer assisted program was developed to process, summarize and map water resources data. The data banks used in the study were analyses of water for water quality performed in the Water Quality Laboratory, water resources survey data from state-wide and county sources, and water rights locations. Spatial maps illustrating the distribution and water quality and quantity parameters and data summaries were prepared for user agencies. The program is not confined to water resource data. Most field and laboratory data have been collected and geographically located according to legal description (township and range). The developed program involves the transformation of geographical location of data sites by legal description into a latitude-longitude system. Once the transformation is completed, large volumes of data can be mapped or displayed using the computer assisted method. (Wiersma-South Dakota)
W79-05792

PROBABLE MAXIMUM PRECIPITATION ESTIMATES, UNITED STATES EAST OF THE 105TH MERIDIAN,
National Weather Service, Silver Spring, MD. Office of Hydrology.
For primary bibliographic entry see Field 2B.
W79-05863

AVAILABILITY OF GROUND WATER IN THE LOWER MERRIMACK RIVER BASIN, SOUTHERN NEW HAMPSHIRE,
Geological Survey, Concord, NH. Water Resources Div.
J. E. Cotton.
Geological Survey Water-Resources Investigations 77-69 (open-file report), 1977. 1 sheet, 14 ref.

Descriptors: *Groundwater resources, *Aquifers, *Groundwater availability, *Water quality, *New Hampshire, Maps, Water wells, Well data, Water yield, *Merrimack River basin(NH).

This map, scale 1:125,000, is a preliminary assessment of the availability of ground water in the lower Merrimack River basin in southern New Hampshire. It is a generalization of several hydrogeologic factors and provides a guideline for ground-water exploration, which is useful in water- and land-use planning. It does not describe the absolute quantity or quality of ground water available. The best aquifers in the basin are deposits of stratified sand or sand and gravel of Pleistocene age. Large aquifers of this type occur in places in the Merrimack River valley and in valleys of tributaries to the Merrimack River. Ground water is generally of good chemical quality. Iron and manganese in concentrations greater than the recommended limits for drinking water suggested by the U.S. Public Health Service, however, are not uncommon. (Woodard-USGS)
W79-05968

POTENTIOMETRIC SURFACE OF FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS, SEPTEMBER 1978,
Geological Survey, Tampa, FL. Water Resources Div.
R. M. Wolansky, L. R. Mills, W. M. Woodham, and C. P. Laughlin.
Geological Survey open-file report 78-1035, 1978. 1 sheet.

Descriptors: *Maps, *Aquifers, *Water levels, *Potentiometric level, *Florida, Water wells, Water utilization, Irrigation, Water level fluctuations, *Floridan aquifer, Southwest Florida Water Management.

A September 1978 potentiometric-surface map depicts the annual high water-level period of the Floridan aquifer in the Southwest Florida Management District. Potentiometric levels increased 10 to 25 feet between May 1978 and September 1978, in the citrus and farming sections of southern Hillsborough, northern Hardee, southwestern Polk and Manatee Counties. These areas are widely affected by pumping for irrigation and have the greatest fluctuations in water-levels between the low and high water-level periods. Water-level rises in coastal, northern and southern areas of the Water Management District ranged from 0 to 10 feet. (Woodard-USGS)
W79-05983

PHYSIOGRAPHY AND SURFICIAL GEOLOGY OF THE COPPER-NICKEL STUDY REGION, NORTHEASTERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
P. G. Olcott, and D. I. Siegel.
Geological Survey Water-Resources Investigations 78-51 (open-file report), 1978. 22 p, 2 fig, 3 plates, 4 tab, 22 ref.

Descriptors: *Geomorphology, *Hydrogeology, *Regional analysis, *Geology, *Minnesota, Topography, Bedrock, Particle size, Petrology, Glacial drift, *Copper-Nickel study region(Minn), Physiography.

The Copper-Nickel study region lies in the Superior Upland physiographic province and is located approximately 60 miles north of Duluth and 100 miles southeast of International Falls, Minnesota. It straddles the Laurentian Divide, which separates Hudson Bay and Lake Superior drainage. The topography exhibits a southwesterly trending lineation that parallels the strike of southeastward-dipping bedrock units and the southwestward direction of ice movement during Pleistocene glaciation. For this study, the region has been divided into seven physiographic areas based on geomorphic features related to the bedrock surface, glacial deposits, and hydrogeologic significance. The surficial geology is largely a result of two southwestward advances of the Rainy Lobe of the Laurentian ice sheet. The Toimi Drumlin Field, the oldest glacial deposit, covers much of the southern part of the region. It is bounded on the north by the Vermilion Moraine Complex, an east-west trending series of terminal and recessional moraines that mark the southerly extent of the second advance of the Rainy Lobe. Thin ground moraine and small outwash deposits occur both within and north of the Vermilion Moraine Complex except in the Embarrass and Dunka River basins where outwash deposits up to 200 feet in thickness fill deep bedrock valley. (Woodard-USGS)
W79-05984

WATER RESOURCES DATA FOR KANSAS WATER YEAR 1978,
Geological Survey, Lawrence, KS. Water Resources Div.
Geological Survey Water-Data Report KS-78-1, January 1979. 656 p, 9 fig, 4 tab.

Descriptors: *Kansas, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Kansas consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells. This report contains discharge records for 147 gaging stations, stage and contents for 21 lakes and reservoirs, water quality for 89 gaging stations and 2 lakes, and water levels for about 460 observation wells and water quality for about 460 wells. Also included are data for 100 crest-stage partial-record stations and 23 low-flow partial-record stations. All data in this report represent that part of the National Water Data System operated by the U. S. Geological Survey and cooperating State and Federal agencies in Kansas. (Woodard-USGS)
W79-05989

8. ENGINEERING WORKS

8A. Structures

EARTH DAMS AND RESERVOIRS,
Soil Conservation Service, Washington, DC. Engineering Div.
For primary bibliographic entry see Field 2H.
W79-05612

REVIEW REPORT ON UMPQUA RIVER AND TRIBUTARIES, OREGON, INTERIM REPORT SOUTH UMPQUA RIVER, VOLUME III; (APPENDIX B--HYDROLOGY, METEOROLOGY AND RESERVOIR REGULATION; APPENDIX C--FOUNDATION AND MATERIALS DATA APPENDIX D--RECREATION, PUBLIC USE AND ENVIRONMENT),
Army Engineers District, Portland, OR.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 90[illegible] Price codes: A14 in paper copy, A01 in microfiche. Interim Report, December 1971. 220 p, 83 fig, tab.

Descriptors: *Dams, *Dam foundations, *Hydrology, *Recreation, *Oregon, Damsites, Rivers, Tributaries, Rainfall, Precipitation(Atmospheric), Reservoirs, Reservoir operation, Geology, Rock, Public access, Environment, Meteorology, Engineering, Civil engineering, +Umpqua River(OR), *South Umpqua River(OR), *Days Creek Dam(OR).

The hydrologic and meteorologic data presented in Appendix B are the bases for establishing channel capacities, reservoir capacity, outlet capacities, spillway design flood, flood control regulation, and water-conservation plans for a comprehensive development of the water resources of South Umpqua River Basin as related to the proposed Days Creek project. That project would be the key storage project in the development of the water resources in the basin. Appendix C shows that foundation conditions and other site considerations are favorable for construction of an embankment-type dam at the proposed site. The site is suitable for use of cut-and-cover construction for the regulating outlet and the diversion conduit

Construction of a diversion tunnel in the right abutment also appears feasible. In Appendix D, the recreation resources associated with this project were described. (Sims-ISWS)
W79-05616

THE CARE OF EXPLOSIVES,
For primary bibliographic entry see Field 8H.
W79-05998

CLAMP-ON DRILLING CENTRALIZER PERMITS PRECISE DIRECTION CONTROL,
Emtec, Inc., Houston, TX.
W. Sullivan, and R. Oder.
The Oil and Gas Journal, Vol. 76, No. 48, p 56-60, November 27, 1978. 2 fig.

Descriptors: *Drilling equipment, *Centralizers, Drilling, Oil industry, Wells, Hole deviation.

A new stabilizer is described which provides string centralization at any point on a drilling bottom hole assembly (BHA). It can more effectively control hole direction either straight or deviated. The tool has survived extreme downhole stress without movement and can be removed easily afterwards. For straight hole drilling a packed BHA can be made by clamping on centralizers as low and as often as desired. For directional drilling, centralizers can be placed at the exact location calculated to produce the desired angle change. Frequent small connections can keep the hole on course, minimize drilling time, and prevent excessive deviation correction or doglegs. The operation, design, and placement of drilling centralizers are described. A new non-magnetic drilling centralizer composed of manganese bronze is designed to run on a monel drill collar to allow stabilization at the point where deviation surveys are taken. Case histories of successful use of the drilling centralizer with test rigs and down-hole motors are presented. (Purdin-NWWA)
W79-05999

WELDING STILL WIDELY USED IN DRILLING INDUSTRY,
Universal Oil Products, Inc., Saint Paul, MN. Johnson Div.
Johnson Drillers Journal, Vol. 50, No. 6, p 4-8, November-December 1978. 1 fig, 3 tab.

Descriptors: *Drilling equipment, *Welding, Well casings, Electrodes, Water wells, Joints(Connections).

Welding is an essential skill of well drillers used for joining lengths of casing into a continuous string without couplings. Techniques and tools needed to make a good weld are described in detail. Most drillers use flux-coated electrodes, but the metallic inert gas, or MIG process, is becoming more common. The advantages of MIG welding are increased ease and speed, deeper weld penetration, and automatic wire feeding. (Purdin-NWWA)
W79-06000

8B. Hydraulics

SUPERCRITICAL FLOW IN BENDS OF TRAPEZOIDAL SECTION,
Missouri Univ., Columbia, Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-05531

MEAN AIR CONCENTRATION OF SELF-AERATED FLOW,
Bureau of Reclamation, Denver, CO.
H. T. Falvey.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, p 91-96, January 1979. 2 fig, 8 ref, 1 append.

Descriptors: *Air entrainment, *Aeration, *Open channel flow, Model studies, Mathematical models, Equations, Air, Mixing, Turbulence, Analytical techniques, Hydraulics, *Air concentration, Aerated flow.

A designer frequently needs to estimate the quantity of air that is transported by open channel flow. A large number of experiments and field measurements have been conducted, but none has led to a simple correlation that relates the mean air concentration with the flow quantities. The purpose of this technical note was to develop a correlation between the mean air concentration and the most significant flow parameters in the fully aerated zone. Dimensional analysis was used to evaluate the relative importance of the various parameters. An expression was developed to approximate the value of the mean air concentration in fully aerated flow. The expression correlated both field and laboratory observations relatively well. Although the expression was developed for fully aerated flow, it possibly could be used to estimate air concentrations in developing flow. (Sims-ISWS)
W79-05537

FLOW PROFILES IN TRAPEZOIDAL CHANNELS BY POCKET CALCULATORS,
Public Power Corp., Athens(Greece). Computing Center.
A. T. Marinos.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY1, Technical Note, p 96-101, January 1979. 2 fig, 1 tab, 1 ref, 1 append.

Descriptors: *Channel flow, *Open channel flow, *Mathematical models, *Computer programs, Flow, Channels, Profiles, Analytical techniques, Mathematics, Equations, Data processing, Hydraulics, *Pocket calculators, Trapezoidal channels.

Determining backwater-curves in trapezoidal channels constitutes a typical problem in open channel hydraulics. For some extreme cases of bulk calculations, a computer, most commonly a desk top one, is required. Excluding the case of a time-sharing system, a desk top computer has the advantage of displaying the results almost immediately after the machine has been fed with the design parameters of the problem. However, present day costs of desk top computers are still rather high, while on the other hand, the price-performance ratio of programmable pocket calculators decreases more drastically compared to the corresponding ratio for desk top computers. The purpose of this note was to indicate the possibility of an efficient use of programmable pocket calculators in solving moderately difficult problems in hydraulics by taking advantage of their low price-performance ratio. With a pocket calculator of more advanced type than the one employed in this research, a more rigorous model for flow profile calculations could be used, and probably other more complex problems in hydraulics could be tackled as well. (Sims-ISWS)
W79-05538

TWO-DIMENSIONAL BUBBLE PLUMES,
New South Wales Univ., Kensington (Australia). Water Research Lab.
D. L. Wilkinson.
Journal of the Hydraulics Division, American Society of Civil Engineers, Proceedings Paper 14385, Vol. 105, No. HY2, p 139-154, February 1979. 9 fig, 2 tab, 13 ref, 3 append.

Descriptors: *Buoyancy, *Bubbles, *Density, Hydraulics, Weber number, Entrainment, Flow, Gases, Ice, Equations, Mathematical studies, Velocity, *Plumes, Two phase flow, Bubble plumes.

The behavior of large- and small-scale bubble plumes was compared with that of plumes in which the buoyancy is miscible with the surrounding fluid. It was found that the structure of bubble plumes is determined by the value of a Weber number based on the ratio of buoyant and surface tension forces at the source. At low Weber numbers, the structure tends to be self-preserving, and the current generating capability is optimized. (Lee-ISWS)
W79-05539

WAVES IN FRONT OF LONG-BASED WEIRS,
Cambridge Univ. (England). Engineering Lab.
A. M. Binnie.
Journal of Hydraulic Research, Vol. 16, No. 4, p 297-307, 1978. 8 fig, 1 tab, 13 ref.

Descriptors: *Weirs, *Channel flow, *Waves(Water), *Model studies, Mathematical models, Theoretical analysis, Channels, Open channel flow, Froude number, Flow, Analytical techniques, Hydraulics, Long-based weirs.

Published details of the flow over long-based weirs indicate the existence of fixed waves on the free surface in front of the weir. Bonham's extensive results were analyzed, and it appears that measurable waves occurred when the Froude number, F, of the approaching stream exceeded 0.4. This is exactly the limit at which waves are seen in an open channel supplied through a contraction, which forms the waves by reducing the momentum of the stream without altering the energy. Thus, the waves seen at the weir were caused, not by the weir, but by the arrangements for producing the stream. This conclusion was supported by experiments in a channel so long that the waves formed by the entry contraction died away before the stream reached the weir. It was shown that, as waves unavoidably formed in a short channel do not greatly disturb the pressure near the bottom, the indications of a float in a well used to measure the weir discharge are not much invalidated if F is kept below 0.6. (Sims-ISWS)
W79-05540

DRAG REDUCTION IN SEWERS: FIRST RESULTS FROM A PERMANENT INSTALLATION,
Bristol Univ. (England). Dept. of Civil Engineering.
R. H. J. Sellin.
Journal of Hydraulic Research, Vol. 16, No. 4, p 357-371, 1978. 8 fig, 1 tab, 11 ref.

Descriptors: *Sewers, *Drag, *Polymers, Flow, Flow rates, Fluid friction, On-site investigations, Equipment, Instrumentation, Water levels, Velocity, Pipes, Municipal wastes, Sewage, Hydraulics, Drag reduction, Polymer dosing.

Tests were described in which drag-reducing polymer additives were used to increase the flow velocity in a municipal sewer. The selected sewer has a diameter of 300 mm, carries the domestic sewage for a population of 10,000, and floods during heavy rainfall due to rainwater infiltration. A permanent polymer dosing station was designed and constructed on this sewer, and flow and depth measurement instruments were included. Although the system was designed to operate automatically during peak discharges, tests were made under dry weather flow conditions which showed increases in sewer velocities of up to 70% using polymer concentrations ranging up to 60 parts per million of Polyox WSR-301. (Sims-ISWS)
W79-05543

8C. Hydraulic Machinery

CAM-LOCK WATER GATE,
Coastal Culvert and Supply, Inc., Eunice, LA. (Assignee).
R. P. DeRouen, and T. Smith.
U.S. Patent No 4,132,385, 8 p, 12 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 978, No 1, p 155, January 2, 1979.

Descriptors: *Patents, *Flow control, *Water control, Gates, High pressure gates, Flow rates, Water gates.

A cam-lock water gate is designed to control the flow of water under pressure and for the purpose of controlling relatively large quantities of water flow from ponds, lakes canal, etc. A primary body member is provided with an aperture and a short section of pipe stub integral with the main body and opening into the aperture. An adjustable gate plate is mounted on the main body and constrained

between parallel guide channels to permit the gate to be adjusted for completely opening the aperture, partially opening the aperture, or completely closing the aperture. A regular duty embodiment employs a simple handle and rod control for adjusting the gate plate as well as locking the cam-lock mechanism to positively retain the gate plate in the set position once adjusted. Another heavy duty embodiment employs heavier materials and heavier construction of the device and also incorporates a security lock bar that enables the gate plate to be locked to prevent unauthorized adjustment. Another embodiment employs a threaded rod with adjusting nut operated by a wheel type control. A modified cam-lock mechanism is also incorporated for locking the gate plate in adjusted position. Rustproof and corrosion resistant materials are used for construction throughout. Because of the lightweight construction all of the devices may be installed without the use of heavy equipment. (Sinha-OEIS)
W79-05951

8E. Rock Mechanics and Geology

PROBLEMS OF THE PERIGLACIAL ZONE (ZAGADNIENIA STREFY PERYGLACJALNEJ),
For primary bibliographic entry see Field 2C.
W79-05545

REVIEW REPORT ON UMPQUA RIVER AND TRIBUTARIES, OREGON, INTERIM REPORT, SOUTH UMPQUA RIVER, VOLUME III; (APPENDIX B--HYDROLOGY, METEOROLOGY, AND RESERVOIR REGULATION; APPENDIX C--FOUNDATION AND MATERIALS DATA; APPENDIX D--RECREATION, PUBLIC USE, AND ENVIRONMENT),
Army Engineers District, Portland, OR.
For primary bibliographic entry see Field 8A.
W79-05616

8F. Concrete

PROCESS FOR PROTECTING ASBESTOS-CEMENT BEARING SURFACES IN RECIRCULATING COOLING WATER SYSTEMS,
Betz Labs., Inc., Trevose, PA. (Assignee).
R. C. Schwarz, and B. G. Chestang.
U.S. Patent No. 4,132,526, 4 p, 11 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 1, p 201, January 2, 1979.

Descriptors: *Patents, *Water treatment, *Industrial water, *Cooling water, Inhibition, Inhibitors, Chemical reactions, Asbestos cement, Water quality control.

A method of inhibiting the destructive effect of water in contact with an asbestos-cement containing structure due to the leaching of the water soluble components of the cement, e.g., calcium and magnesium is described. Water soluble organo phosphonic acid derivatives, water soluble organic and inorganic phosphates, including esters, water soluble polymers of acrylic acid, and water soluble silicates and mixtures are added to water systems. These materials act to change the interfacial surface of the asbestos-cement structures such that the overall solubility of the components of the cement is reduced. It is believed that there is a reaction with the soluble ions, namely calcium and magnesium of the cement to produce a reaction product which is not soluble in water, in essence protecting the interfacial surface. The materials generally may be added in an amount of 0.1 to 10,000, and preferably from about 1 to 100, parts per million parts of water in the system. The treatment will be most effective if water in the system is maintained or adjusted with either base or acid to a pH of 6 to 10 and maintained at a positive Langelier. (Sinha-OEIS)
W79-05949

8H. Rapid Excavation

THE CARE OF EXPLOSIVES,
R. B. McDannald.
Water Well Journal, Vol. 33, No. 1, p 34-35, January 1979.

Descriptors: *Explosives, *Hazards, *Safety, Storage, Transportation, Shot firing, Drilling, Water wells, Well development, Water yield.

Explosives are versatile, economical and efficient tools in the water well industry. Safety measures to take when shooting with electric caps include: (1) During electric storms or dust storms, don't uncoil wires or use electric blasting caps; (2) When a storm is within eight miles, inform all persons to stay clear of the blasting area; (3) In the immediate vicinity of radio-frequency transmitters, don't uncoil wires or use electric blasting caps; (4) Keep the firing circuit completely insulated from the ground and other conductors; (5) Keep the electric cap wires disconnected from the power source and short circuited until ready to fire. When transporting explosives to the well site a driller should: (1) obey all federal, state and local laws and regulations, (2) prohibit smoking in the vehicle; (3) load and unload explosives carefully; (4) transport blasting caps, metal, flammable or corrosive substances in a separate vehicle. Precautions to be taken in storing explosives include those listed for transporting explosives plus the following: (1) store only in a magazine which is clean, properly located, substantially built, bullet and fire resistant and security locked, (2) if nitroglycerin from deteriorated explosives has leaked it should be washed away thoroughly with a desensitizing agent. (Purdin-NWWA)
W79-05998

8I. Fisheries Engineering

THE CULTURE OF THE DIATOM CHAETOCEROS GRACILIS AND ITS USE AS A FOOD FOR PENAEID PROTOZOEAL LARVAE,
Oceanic Inst., Waimanalo, HI.
For primary bibliographic entry see Field 5C.
W79-05738

FOURTH NATIONAL WORKSHOP ON ENTRAINMENT AND IMPINGEMENT,
For primary bibliographic entry see Field 5C.
W79-05754

ENGINEERING IMPLICATIONS OF NEW FISH SCREENING CONCEPTS,
Stone and Webster Engineering Corp., Boston, MA.
Y. G. Mussalli, E. P. Taft, and P. Hofmann.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL., p 367-376, 1978. 9 fig, 14 ref.

Descriptors: *Engineering structures, *Environmental effects, *Intakes, Intakes structures, Engineering, Fish, Screens, Powerplants, Entrainment, *Impingement.

New concepts in screen design, orientation and operation which offer good potential for biological effectiveness are reported. Fish collection and removal concepts involve modifications of conventional traveling water screens so that impinged fish can be removed with minimal stress and mortality. The fish diversion concept employs design features to remove fish from intakes without requiring that they be physically impinged on mechanical screens. The formation of eddies and areas of flow separation downstream in the vicinity of the pump may affect pump performance. Devices have been developed that are designed to alter or take advantage of fish behavioral patterns so that they will avoid entering the intake flow. The use of devices using this concept need to be carefully evaluated for their effect on intake operation. The choice of design depends on its particular effectiveness for the species of fish and on engineering and cost considerations. (See also W79-05754) (Chilton-ORNL)
W79-05785

MULTIFARIOUS POWER PLANT WATER INTAKE STRUCTURE: A DESIGN TO REDUCE IMPINGEMENT AND ENTRAINMENT MORTALITY,
Polytechnic Inst. of New York, Brooklyn. Div. of Civil and Environmental Engineering.
A. S. Goodman, and B. Chezar.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL., p 377-384, 1978.

Descriptors: *Engineering structures, *Intakes, *Intakes structures, Entrainment, Engineering, Fish, Mortality, Screens, Powerplants, *Impingement.

The design and operation of the structure described are based on, and relate to, knowledge of the concentration, distribution and behavior of aquatic organisms as well as the physical characteristics of rivers and estuaries. The principal biological design features are: adjustable louvers in front of the intake structure to act as a behavioral barrier to fish; curtain walls in front of the screens to provide three alternative levels of water withdrawal; horizontal traveling screens which move in the directions and speed of the ambient water flow; fish handling facilities located between bays and at either end of the intake. The work described has been primarily a desk study and a research and development program is recommended before construction is considered. (See also W79-05754) (Chilton-ORNL)
W79-05786

PRELIMINARY STUDIES ON THE OPERATING ASPECTS OF SMALL SLOT WIDTH WEDGEWIRE SCREENS WITH CONCEPTUAL DESIGNS FOR POWER STATION USE,
United Engineers and Constructors, Inc., Philadelphia, PA.
T. H. Key, and J. C. Miller.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL. p 385-392, 1978. 11 fig.

Descriptors: *Engineering structures, *Intakes, *Intakes structures, Cooling water, Entrainment, Environmental effects, Screens, Powerplants.

A prototype intake facility using removable bulkhead-mounted wedgewire screens was evaluated for long-term operating aspects. Results have indicated that the system will operate satisfactorily, with an acceptable level of operation and maintenance. The major problem with the system has been marine biofouling which requires manual cleaning of the screen on a regular basis. Concurrent material testing indicates that the biofouling can be reduced by the use of copper-bearing material. (See also W79-05754) (Chilton-ORNL)
W79-05787

A PRACTICAL INTAKE SCREEN WHICH SUBSTANTIALLY REDUCES THE ENTRAINMENT AND IMPINGEMENT OF EARLY LIFE STAGES OF FISH,
Ichthyological Associates, Inc., Middletown, DE.
B. N. Hanson, W. H. Bason, B. E. Beitz, and K. E. Charles.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL., p 393-407, 1978. 6 fig, 6 tab, 5 ref.

Descriptors: *Engineering structures, *Intakes, *Intakes structures, Fish, Environmental effects, Entrainment, Screens, Powerplants, *Impingement.

This study demonstrates that profile wire screens have less impact on the aquatic environment than intakes protected by traveling screens. The ability to reduce entrainment and impingement results from the infinite number of escape routes available the flow dynamics; the rapid decline in approach

velocity as a fish leaves the screen; the small slot size; and the ambient washing currents. Impingement of fish larger than 20 mm fork length is virtually eliminated. Biofouling is a major operational problem in brackish and marine waters. (See also W79-05754) (Chilton-ORNL)
W79-05788

FISHERIES ISSUES RELATED TO WATER DEVELOPMENT IN THE SACRAMENTO-SAN JOAQUIN ESTUARY, CALIFORNIA,
California State Dept. of Fish and Game, Stockton.
For primary bibliographic entry see Field 6G.
W79-05789

PRESENT ENGINEERING LIMITATIONS TO THE PROTECTION OF FISH AT WATER INTAKES,
Burns and Roe, Inc., Paramus, NJ.
R. T. Richards.
In: Fourth National Workshop on Entrainment and Impingement, December 5, 1977, Chicago, IL., p 415-424, 1978. 9 fig, 11 ref.

Descriptors: *Engineering structures, *Environmental effects, *Entrainment, Fish, Intakes, Screens, *Impingement.

This paper discusses the constraints which engineering practicality imposes on the design of fish protection devices. It is suggested that the most practical fish screening approaches include optimization of the location of the point of water withdrawal to avoid concentrations of aquatic organisms; the use of velocity cap horizontal inflow provisions for offshore withdrawals; the use of conventional vertical straight-through traveling screens with limitations on screen approach velocities; angling of the vertical screen arrays to guide fish to escape sluiceways; flush mounting of screens combined with openings in support walls to provide an unobstructed fish passage escape; modification of conventional vertical screens to include fish removal sprays, fish collection lips and a means of bringing the organisms to a recovery system external to the intake itself. (See also W79-05754) (Chilton-ORNL)
W79-05790

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

DOCUMENTATION OF DATA AND LITERATURE RELEVANT TO THE ASSESSMENT OF THERMAL POWER PLANT COOLING SYSTEM EFFECTS ON AQUATIC ENVIRONMENTS,
Atomic Industrial Forum, Inc., Washington, DC.
For primary bibliographic entry see Field 5C.
W79-05784

TECHNOLOGY AND ECONOMICS OF INDUSTRIAL POLLUTION ABATEMENT,
Illinois Inst. for Environmental Quality, Chicago.
For primary bibliographic entry see Field 5B.
W79-05865

10C. Secondary Publication And Distribution

BIBLIOGRAPHY OF PUBLICATIONS ON COMPOUNDS OF GAS HYDRATE TYPE,
Pittsburgh, Univ., PA.
K. W. Allen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 512, Price codes: A02 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 73, August 1963. K. Kase, Ed. 13 p.

Descriptors: *Bibliographies, *Publications, *Desalination, Hydrates, Gases, Chlorine.

An alphabetical listing, by authors, of complete references for chlorine hydrate, and the significant recent references for all compounds of the gas hydrate type is presented. (Davison-IPA)
W79-05572

ESTUARINE RESEARCH: AN ANNOTATED BIBLIOGRAPHY OF SELECTED LITERATURE, WITH EMPHASIS ON THE HUDSON RIVER ESTUARY, NEW YORK AND NEW JERSEY,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2L.
W79-05593

SUBJECT INDEX

ABSTRACTS
Estuarine Research: An Annotated Bibliography of Selected Literature, With Emphasis on the Hudson River Estuary, New York and New Jersey,
W79-05593 2L

Groundwater Pollution. Part 2. Pollution from Irrigation and Fertilization. Vol. 2. 1977-January, 1978. (Citations from the NTIS Data Base),
W79-05826 5B

ABUNDANCE
Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity - Their Numbers and Seasonal Movements,
W79-05674 5C

The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

ACETATE
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

ACID MINE WATER
Surface Water Quality Associated with the Surface Mining of Iowa Coal,
W79-05834 5B

ACID PRECIPITATION
Acid Precipitation in the New York Metropolitan Area: Its Relationship to Meteorological Factors,
W79-05626 2K

ACIDS
Acid Precipitation in the New York Metropolitan Area: Its Relationship to Meteorological Factors,
W79-05626 2K

ACOUSTICS
An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

ACTIVATED CARBON
Adsorption of Virus on Activated Carbon Under Varying Water Chemistry Conditions,
W79-05831 5D

ACTIVATED SLUDGE
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

ACTUAL EVAPOTRANSPIRATION
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

ADELAIDE (AUSTRALIA)
Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

ADMINISTRATIVE AGENCIES
The Founding of the Salt River Water Users Association,
W79-05555 6E

ADSORPTION
Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

Research on Condensation Mechanisms,
W79-05882 3A

Influence of the Chemical Form of Mercury on Its Adsorption and Ability to Leach Through Soils,
W79-05944 5B

AERATION
Mean Air Concentration of Self-Aerated Flow,
W79-05537 8B

AERIAL PHOTOGRAPHY
Flight Path Curvature Distortion in Side-Looking Airborne Radar Imagery,
W79-05973 7B

AGRICULTURAL RUNOFF
Influence of Non-Point Pollution Sources in Connection with the Tuy River Basin Sanitation Studies,
W79-05740 5A

AGRICULTURAL WATERSHEDS
Monitoring Areawide Rural Water Quality,
W79-05842 5A

AGRICULTURE
Assessment of Weather Modification in Alleviating Agricultural Water Shortages During Droughts,
W79-05836 2B

AGROCLIMATOLOGY
Twentieth-Century Semi-Arid Climates and Climatic Fluctuations in Texas and Northeastern Mexico,
W79-05563 2A

AIR CONCENTRATION
Mean Air Concentration of Self-Aerated Flow,
W79-05537 8B

AIR ENTRAINMENT
Mean Air Concentration of Self-Aerated Flow,
W79-05537 8B

AIR POLLUTION
Congestion, Pollution, and Impure Public Goods,
W79-05748 6C

Growth Effects of Major Land Use Projects (Wastewater Facilities), Volume I: Model Specification and Causal Analysis,
W79-05866 6G

Precipitation and Throughfall Chemistry in the San Francisco Bay Area,
W79-05937 5B

AIR POLLUTION EFFECTS
Ocean-Atmosphere Interactions Off the Northeast Coast of North America,
W79-05681 5B

ALASKA
Baseline Characterization of Marine Mammals in the Bering Sea: Distribution and Abundance,
W79-05665 5C

Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska,
W79-05666 5C

Seasonal Distribution and Abundance of Bowhead and Beluga Whales in the Bering Sea and Arctic Ocean,
W79-05667 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. I: Breeding Bird Use of Barrier Islands in the Northern Chukchi and Beaufort Seas,
W79-05676 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. II: Feeding Habits of Birds in the Beaufort Sea,
W79-05677 5C

Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5C

Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation,
W79-05885 5C

Ecological Studies in the Northern Bering Sea: Studies of Seabirds in the Bering Strait,
W79-05891 5C

Catalog of Alaskan Seabird Colonies,
W79-05902 5C

Survey of Beached Marine Birds in Alaska,
W79-05903 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

ALBERTA (CANADA)
Wet and Dry Deposition of Nutrients in Central Alberta,
W79-05849 5B

ALGAE
Importance of Algae in the Diet of the Oligochaetes Lumbriculus Variegatus (Muller) and Rhyacodrulus Sodalis (Eisen),
W79-05517 5C

Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

Part I: Survey of Physiological Mechanisms of Sodium and Chloride Ion Transport and Design of Experiment for Application to Demineralizing Saline Waters - Part II: Laboratory Evaluation of Use of Algae in Saline Water Conversion -- Phase I Final Report,
W79-05648 3A

Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

ALGAE

Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

ALLENTOWN (PA)
Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

ANALYTICAL TECHNIQUES
Application of Hydraulic and Hydrologic Data in Urban Stormwater Management,
W79-05588 6A

Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

Perils of the Orderly Mind: Cost-Benefit Analysis and Other Logical Pitfalls,
W79-05751 6B

Flight Path Curvature Distortion in Side-Looking Airborne Radar Imagery,
W79-05973 7B

Concentrations of Metals in Very Small Volumes of Soil Solution,
W79-05976 7B

Flood-Plain Delineation for Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, and Thompson Creek, Fairfax County, Virginia,
W79-05986 6A

ANISOTROPY
Freezing Process Studies,
W79-05653 3A

ANTARCTIC
Climatic Roles of Ice: A Contribution to the International Hydrological Programme (IHP),
W79-05527 2C

Effect of Climatic Warming on the West Antarctic Ice Sheet,
W79-05528 2C

A Large-Scale Numerical Model of Sea Ice,
W79-05632 2C

ANTARCTIC OCEAN
A Large-Scale Numerical Model of Sea Ice,
W79-05632 2C

ANTIBIOTICS (PESTICIDES)
Antimicrobial Resistant Bacteria in the New York Bight,
W79-05708 5C

ANTLERS AQUIFER
Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

APHANOTHECE HALOPHYTICA
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

APPALACHIAN MOUNTAIN REGION
National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

Walker Branch Watershed: Site Description and Research Scope,
W79-05837 2A

APPLICATION EQUIPMENT
Casing Mounted Emitter,
W79-05953 3F

APPLICATION METHODS
Classification of Evaluation of Flood Flow Frequency Estimation Techniques,
W79-05844 2E

AQUATIC ALGAE
Patterns of Algal Succession in a Perturbated Marine Intertidal Community,
W79-05664 5C

AQUATIC BIRDS
Evaluation of Planning for Fish and Wildlife, Lake Sharpe Reservoir Project,
W79-05717 6G

AQUATIC ENVIRONMENT
Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

AQUATIC LIFE
Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

AQUATIC PLANTS
Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

Plant Communities of Alaskan Arctic Beaches,
W79-05910 5C

AQUATIC WEED CONTROL
A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

Simazine Residue Levels in Irrigation Water After Ditchbank Application for Weed Control,
W79-05821 5B

AQUICULTURE
The Culture of the Diatom Chaetoceros Gracilis and Its Use as a Food for Penaeid Protozoeal Larvae,
W79-05738 5C

AQUIFER CHARACTERISTICS
Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

The Mississippi River Valley Alluvial Aquifer in Mississippi,
W79-05597 7C

Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

AQUIFER SYSTEMS
Tritium Dating of Some Groundwater Samples from Northwestern Iraqi Desert,
W79-05569 2F

AQUIFERS
Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

Selected Water-Level Records for Oklahoma, 1975-1977,
W79-05604 2F

Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

Possible Mechanisms for Leakage Between Aquifers and Rivers,
W79-05851 2F

The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire,
W79-05968 7C

Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

ARABLE LAND
Potential Use of Converted Sea Water for Irrigation in Parts of California and Texas,
W79-05645 3A

ARCTIC
Analysis of Cool Season Lake-Related Mesoscale Phenomena Using Numerical Variational Analysis,
W79-05523 2B

Eastern-Western Arctic Sea Ice Analyses,
W79-05613 2C

A Large-Scale Numerical Model of Sea Ice,
W79-05632 2C

Beaufort Sea Plankton Studies,
W79-05912 5C

ARCTIC OCEAN
A Large-Scale Numerical Model of Sea Ice,
W79-05632 2C

Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

ARIZONA
Evaluation of Proposed TG and E (Tucson Gas and Electric Company) Wastewater Discharge on Groundwater in the Tucson Basin,
W79-05519 5E

Groundwater Projections for 11 Basins,
W79-05554 4B

Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

Major Chemical Constituents of Arizona Lakes
W79-05567 2K

The Cap - Who Needs It.
W79-05568 6E

AROMATIC COMPOUNDS
Sources and Fates of Aromatic Compounds in Urban Stormwater Runoff,
W79-05627 5A

ASSESSMENTS
Possibilities for Assessment of the Effects of Power Plant Operation at the Ecosystem Level,
W79-05780 5C

A Mathematical Model of the Interactions of an Aquatic Ecosystem and a Thermal Power Station Cooling System,
W79-05781 5C

ATLANTA AREA
Modeling Nitrogen, Oxygen, Chattahoochee River, GA.,
W79-05974 5B

ATTITUDES
The Perception and Valuation of Water Quality: A Review of Research Method and Findings,
W79-05723 6B

AVAILABLE WATER
Water Resources of South-Central Iowa,
W79-05609 7C

Water Resources of the Upper Duck River Basin, Central Tennessee,
W79-05985 6D

BACTERIA
Nitrates and Bacterial Distribution in Rural Domestic Water Supplies,
W79-05524 5B

Distribution of Suspended Bacteria in the Newport River Estuary, North Carolina,
W79-05623 2L

Bacterial Flux in Some New Jersey Estuarine Sediments,
W79-05704 2L

Antimicrobial Resistant Bacteria in the New York Bight,
W79-05708 5C

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

BADGER-HICKMAN STILL
A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

BASE CASE DESALTING COSTS
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

BASE FLOW
Selected Low-Flow Characteristics of Streams in the Vicinity of Warwick, Orange County, New York,
W79-05595 2E

BASELINE STUDIES
Baseline Characterization of Marine Mammals in the Bering Sea: Distribution and Abundance,
W79-05665 5C

Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska,
W79-05666 5C

Seasonal Distribution and Abundance of Bowhead and Beluga Whales in the Bering Sea and Arctic Ocean,
W79-05667 5C

Morbidity and Mortality of Marine Mammals,
W79-05668 5C

Biology of the Harbor Seal, Phoca Vitulina Richardi, in the Gulf of Alaska,
W79-05669 5C

The Natural History and Ecology of the Bearded Seal (Erignathus Barbatus) and the Ringed Seal (Phoca Hispida),
W79-05670 5C

An Amendment to RU232 Trophic Relationships Among Ice Inhabiting Phocid Seals, and RU230 Natural History of Ringed and Bearded Seals,
W79-05672 5C

A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity - Their Numbers and Seasonal Movements,
W79-05674 5C

Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5B

Physical Oceanography of the Middle Atlantic Bight,
W79-05680 2J

Ocean-Atmosphere Interactions Off the Northeast Coast of North America,
W79-05681 5B

New York Bight Water Stratification--October 1974,
W79-05682 1A

Distribution of Hydrographic Properties in the New York Bight Apex,
W79-05683 1A

Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

Developmental Tests on the Use of Fluorescent Tracers and Backwash Sediment-Load Samplers to Measure the Beach Drift Component of Littoral Transport at Sandy Hook, New Jersey,
W79-05688 2J

Raritan Bay as a Source of Ammonium and Chlorophyll A for the New York Bight Apex,
W79-05693 5B

Middle Atlantic Fisheries: Recent Changes in Populations and Outlook,
W79-05700 5C

Bacterial Flux in Some New Jersey Estuarine Sediments,
W79-05704 2L

Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida,
W79-05839 5C

Ecological Studies in the Northern Bering Sea: Studies of Seabirds in the Bering Strait,
W79-05891 5C

The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

Dynamics of Marine Bird Populations on the Barren Islands, Alaska,
W79-05899 5C

Community Structure of Seabirds of Wooded Island, Alaska,
W79-05900 5C

The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

Survey of Beached Marine Birds in Alaska,
W79-05903 5C

Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

The Distribution, Abundance, Diversity and Productivity of the Western Beaufort Sea Benthos,
W79-05906 5C

Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

Beaufort Sea Plankton Studies,
W79-05912 5C

Bibliography on the Transfer of Synthesized Organic Matter to Zooplankton, Micronekton, and Ichthyoplankton,
W79-05919 5C

Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

BAY ST. LOUIS (MS)
A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

BAYS
Long Wave Model Independent of Stability Criteria,
W79-05534 2L

Seasonal Changes in Oxygen Uptake by Settled Particulate Matter and Sediments in a Marine Bay,
W79-05638 2L

Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

BEACH EROSION
Longshore Transport at a Total Littoral Barrier,
W79-05838 2H

BEACHED BIRDS
Survey of Beached Marine Birds in Alaska,
W79-05903 5C

BEACHES
The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

Longshore Transport at a Total Littoral Barrier,
W79-05838 2H

Plant Communities of Alaskan Arctic Beaches,
W79-05910 5C

BEAR RIVER BASIN
Water Resources Data for Wyoming, Water Year 1977--Volume 2. Green River Basin, Bear River Basin, Snake River Basin,
W79-05599 7C

BEAUFORT SEA
Plant Communities of Alaskan Arctic Beaches,
W79-05910 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Overview and Synthesis,
W79-05927 5C

BED LOAD
Statistical Analysis of Concentration Records,
W79-05535 2J

BEDFORD BASIN (NOVA SCOTIA)
Seasonal Changes in Oxygen Uptake by Settled Particulate Matter and Sediments in a Marine Bay,
W79-05638 2L

Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

BEDROCK
Estimation of Transmissivity and Permeability in Swedish Bedrocks,
W79-05551 2F

BENTHIC FAUNA
Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

BENTHIC FAUNS
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters,
W79-05718 5C

BENTHIC FLORA
Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

BENTHOS
Benthic Colonization Processes--A Review and a Proposed New Model,
W79-05707 5C

Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

The Distribution, Abundance, Diversity and Productivity of the Western Beaufort Sea Benthos,
W79-05906 5C

Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

BEST MANAGEMENT PRACTICES (BMP)
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

BIBLIOGRAPHIES
Bibliography of Publications on Compounds of Gas Hydrate Type,
W79-05572 10C

Estuarine Research: An Annotated Bibliography of Selected Literature, With Emphasis on the Hudson River Estuary, New York and New Jersey,
W79-05593 2L

Demineralization of Saline Waters: A Preliminary Discussion of a Research Program,
W79-05655 3A

Groundwater Pollution. Part 2. Pollution from Irrigation and Fertilization. Vol. 2. 1977-January, 1978. (Citations from the NTIS Data Base),
W79-05826 5B

Bibliography on the Transfer of Synthesized Organic Matter to Zooplankton, Micronekton, and Ichthyoplankton,
W79-05919 5C

BIOCHEMISTRY
Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

BIODEGRADATION
Biological Recovery Versus Desertization,
W79-05556 5B

The Relationship Between Economic Development and Ecological Degradation: How Degradation has Occurred in West Africa and How Its Progress Might be Halted,
W79-05565 6B

BIOLOGICAL COMMUNITIES
Patterns of Algal Succession in a Perturbated Marine Intertidal Community,
W79-05664 5C

Community Structure, Dynamics and Nutrients Cycling in the Okefenokee Cypress Swamp-Forest,
W79-05746 5C

Walker Branch Watershed: Site Description and Research Scope,
W79-05837 2A

BIOLOGICAL TREATMENT
Wastewater Treatment,
W79-05963 5D

BIOLOGY
Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

BIOMASS
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters,
W79-05718 5C

Community Structure, Dynamics and Nutrients Cycling in the Okefenokee Cypress Swamp-Forest,
W79-05746 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

BIRDS
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska,
W79-05675 5C

Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5C

Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation,
W79-05885 5C

Shorebird Dependence on Arctic Littoral Habitats,
W79-05886 5C

The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-05890 5C

Ecological Studies in the Northern Bering Sea: Studies of Seabirds in the Bering Strait,
W79-05891 5C

Ecological Studies of Colonial Seabirds at Cape Thompson and Cape Lisburne, Alaska,
W79-05892 5C

Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

Breeding and Population Ecology of Fulmars at Semidi Islands, Alaska, with Observations on the Reproduction of Sympatric Seabird Species,
W79-05895 5C

Studies of Marine Birds on Ugaiushak Island,
W79-05896 5C

The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

Dynamics of Marine Bird Populations on the Barren Islands, Alaska,
W79-05899 5C

Community Structure of Seabirds of Wooded Island, Alaska,
W79-05900 5C

The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

Catalog of Alaskan Seabird Colonies,
W79-05902 5C

Survey of Beached Marine Birds in Alaska,
W79-05903 5C

Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Overview and Synthesis,
W79-05927 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Avian Ecology in Simpson Lagoon, 1977,
W79-05928 5C

BISCAYNE AQUIFER
Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

BLACK LIQUOR
Water Extraction from Black Liquors (Ekstraktsiya vody iz rastvorov chernogo shcheloka),
W79-05502 5D

BLUE RIDGE MOUNTAINS
National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

BORDER IRRIGATION
Mathematical Models and Border Irrigation Design,
W79-05991 3F

Border-Strip Irrigation Design--Practical Approach from a Theoretical Basis,
W79-05992 3F

BORMIDA RIVER (ITALY)
Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

BORROW PONDS (FL)
Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

BOTTOM SEDIMENTS
Seasonal Changes in Oxygen Uptake by Settled Particulate Matter and Sediments in a Marine Bay,
W79-05638 2L

Benthic-Pelagic Coupling in the New York Bight,
W79-05706 5C

Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

BOULDER--FORT COLLINS--GREELEY AREA
Hydrologic Data for Water-Table Aquifers in the Boulder--Fort Collins--Greeley Area, Front Range Urban Corridor, Colorado,
W79-05594 7C

BOUSSINESQ EQUATION
The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

BOWEN RATIO
Regional Mean Bowen Ratios Deduced from Diurnal Changes of Temperature and Humidity,
W79-05883 2A

BRACKISH WATER
Corrosion of Metals in Sea Water,
W79-05870 3A

BRACKISH WATER CONVERSION DEMONSTRATION PLANT NO. 3
Saline Water Conversion Demonstration Plant, Webster, South Dakota: First Annual Report,
W79-05577 3A

BRATTHAMMAR (SWEDEN)
Local Infiltration of Storm Water,
W79-05550 4A

BREEDING
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. I: Breeding Bird Use of Barrier Islands in the Northern Chukchi and Beaufort Seas,
W79-05676 5C

Breeding and Population Ecology of Fulmars at Semidi Islands, Alaska, with Observations on the Reproduction of Sympatric Seabird Species,
W79-05895 5C

The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

Effects of Petroleum Exposure on the Breeding Ecology of the Gulf of Alaska Herring Gull Group and Reproductive Ecology of Large Gulls in the Northeast Gulf of Alaska,
W79-05923 5C

BRINE DISPOSAL
Disposal of Saline Water Conversion Brines -- An Orientation Study,
W79-05657 3A

BRITISH COLUMBIA
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

BROMEGRASS
The Uptake of 203Hg-Labeled Mercury Compounds by Bromegrass from Irrigated Undisturbed Soil Columns,
W79-05943 5B

BROWARD COUNTY
Effects of Land Use and Water Management on Water Quality in the Western South New River Canal Basin, Southeast Florida, 1974-75,
W79-05978 4C

BRYAN (TX)
Special Flood Hazard Information: Turkey Creek, Bryan, Texas.
W79-05716 2E

BUBBLES
Two-Dimensional Bubble Plumes,
W79-05539 8B

BUOYANCY
Two-Dimensional Bubble Plumes,
W79-05539 8B

CADMIUM
Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

Water Relations of Cadmium-Treated Plants,
W79-05934 2I

CALCITE
Electron Probe Microanalysis of Calcite Grains Containing Phosphorus in Soil,
W79-05810 2G

CALCIUM SULFATE
Investigation of Supersaturation in Saline Water Conversion,
W79-05872 3A

CALIFORNIA
Longshore Transport at a Total Littoral Barrier,
W79-05838 2H

CANADA
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

Migrating Thermal Structure in a Freshwater Thermocline,
W79-05636 2H

Seasonal Changes in Oxygen Uptake by Settled Particulate Matter and Sediments in a Marine Bay,
W79-05638 2L

Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

Wet and Dry Deposition of Nutrients in Central Alberta,
W79-05849 5B

CANALS
Effects of Land Use and Water Management on Water Quality in the Western South New River Canal Basin, Southeast Florida, 1974-75,
W79-05978 4C

CAPITAL COSTS
A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

CARBOHYDRATES
Carbohydrates and Organic Carbon in New York Bight Sediments as Possible Indicators of Sewage Contamination,
W79-05695 5B

CARBON
Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

CARBON RADIOISOTOPES
The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

CATALOGS
Catalog of Alaskan Seabird Colonies,
W79-05902 5C

CATFISH
Predicting Nighttime Oxygen Depletion in Catfish Ponds,
W79-05800 2H

CATION EXCHANGE
Cation Exchange Equilibria in a Mixed Soil System Containing Three Heterovalent Cations, W79-05808 2G

CATIONS
Leaching of Cations and Chloride from Manure Applied to an Irrigated Soil, W79-05931 5B

CATTARAUGUS COUNTY (NY)
Installation of Water- and Gas-Sampling Wells in Low-Level Radioactive-Waste Burial Trenches, West Valley, New York, W79-05970 5B

CEDAR CREEK (PA)
Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins, W79-05721 4A

CELLULOSE
Study of Oriented Cellulose Membranes for Reverse Osmosis and the Relationship Between Morphology and Salt Rejection, W79-05879 3A

CENSUS
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas, W79-05610 4D

CENTRAL US
A Compendium of Lake and Reservoir Data Collected by the National Eutrophication Survey in the Central United States. W79-05732 5C

CENTRALIZERS
Clamp-On Drilling Centralizer Permits Precise Direction Control, W79-05999 8A

CESIUM
Seasonal Cycling of Cesium-137 in a Reservoir, W79-05622 5B

CETACEANS
A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity - Their Numbers and Seasonal Movements, W79-05674 5C

CHAETOCEROS GRACILIS
The Culture of the Diatom Chaetoceros Gracilis and Its Use as a Food for Penaeid Protozoeal Larvae, W79-05738 5C

CHALK AQUIFER
The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin, W79-05852 2F

CHANNEL FLOW
Flow Profiles in Trapezoidal Channels by Pocket Calculators, W79-05538 8B

Waves in Front of Long-Based Weirs, W79-05540 8B

Subsidence of Peak Flow in Channels with Storage Areas, W79-05541 2E

The Modeling of Tidal Flow in a Channel Using a Turbulence Energy Closure Scheme, W79-05637 2L

CHATTAHOOCHEE RIVER
Modeling Nitrogen, Oxygen, Chattahoochee River, GA., W79-05974 5B

CHELATION
Investigation of Chelation as a Means of Removing Ions from Sea Water, W79-05868 3A

CHEMICAL ANALYSIS
Major Chemical Constituents of Arizona Lakes, W79-05567 2H

Concentrations of Metals in Very Small Volumes of Soil Solution, W79-05976 7B

CHEMICAL OXYGEN DEMAND
Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida, W79-05839 5C

CHEMICAL PROPERTIES
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes, W79-05564 5C

Major Chemical Constituents of Arizona Lakes, W79-05567 2H

CHEMISTRY
Chemistry of Nitrification-Denitrification Process, W79-05737 5D

CHILE
Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water, W79-05643 5B

CHIRONOMIDAE
Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska, W79-05965 2A

CHLORIDES
Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: I. Nitrate-Nitrogen and Chloride Distribution in Soil Profiles, W79-05641 5B

Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: II. Nitrogen and Chloride Transport in Runoff, W79-05642 5B

CHLORINATION
The Recovery and Hematological Rehabilitation of Chlorine Stressed Adult Rainbow Trout (Salmo Gairdneri), W79-05515 5C

CHLOROPHYLL
Phytoplankton Productivity in the Apex of the New York Bight: Environmental Regulation of Productivity/Chlorophyll A, W79-05697 5B

CHROMOSOME MUTAGENESIS
Chromosome Mutagenesis in Developing Mackerel Eggs Sampled from the New York Bight, W79-05703 5C

CIRCULATION AIR
Dry Climates--Past and Present, W79-05570 2A

CITIES
Geohydrological Research at the Chalmers University of Technology, Goteborg. W79-05546 4C

Local Infiltration of Storm Water, W79-05550 4A

CLAMS
Distribution and Abundance of Inshore Populations of the Surf Clam Spisula Solidissima, W79-05710 5C

CLASSIFICATION
Proceedings for Gathering Ground Truth Information for a Supervised Approach to a Computer-Implemented Land Cover Classification of Landsat-Acquired Multispectral Scanner Data, W79-05859 7B

CLIMATIC DATA
Twentieth-Century Semi-Arid Climates and Climatic Fluctuations in Texas and Northeastern Mexico, W79-05563 2A

CLIMATOLOGY
Climatic Roles of Ice: A Contribution to the International Hydrological Programme (IHP), W79-05527 2C

Effect of Climatic Warming on the West Antarctic Ice Sheet, W79-05528 2C

Dry Climates--Past and Present, W79-05570 2A

CLOUD SEEDING
Assessment of Weather Modification in Alleviating Agricultural Water Shortages During Droughts, W79-05836 3

COAL MINE WASTES
Growth and Elemental Composition of Corn and Bean Seedlings as Influenced by Soil Application of Coal Ash, W79-05942 5

COAL MINES
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado, W79-05975 6

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado, W79-05987 6

COASTS
Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Overview and Synthesis, W79-05927 2

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Ecology of Fishes in Simpson Lagoon, 1977, W79-05929 2

COCOA PODS
Dew and Thermal Lag: A Model for Cocoa Pods, W79-05856

COLD RESISTANCE
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters, W79-05718

COLIFORMS
Transport of Antibiotic-Resistant Escherichia Coli Through Western Oregon Hillslope Soils Under Conditions of Saturated Flow, W79-05932

COLLIN COUNTY (TX)
Flood Plain Information: Maxwell Creek, Parker, Texas, W79-05719

COLLINSVILLE QUADRANGLE
Map Showing Drainage Areas, Collinsville Quadrangle, Connecticut, W79-05603

LORADO
Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

Disposal of a Large Quantity of Sodium Fluoracetate in a Sanitary Landfill Site Located in an Aquifer Recharging Area,
W79-05835 5G

Water and Energy in the Western Coal Lands,
W79-05845 6D

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

LORADO RIVER
Water and Energy in the Western Coal Lands,
W79-05845 6D

LUMBIA QUADRANGLE
Map Showing Drainage Areas, Columbia Quadrangle, Connecticut,
W79-05600 7C

MBINED SEWERS
Stormwater Interception and Storage,
W79-05625 2E

Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

MMERCIAL ALGAE HARVESTING
Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

MPETITIVE PRICES
Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

MPREHENSIVE PLANNING
Traditional Perceptabilities (Sic.) of Environment and Desertification: A Case Study,
W79-05562 6B

MPUTER MODEL
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

MPUTER MODELS
The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

A Demonstration of Areawide Water Resources Planning--Users Manual,
W79-05715 6A

Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

Mathematical Model and Computer Simulation of the Population Dynamics of Zooplankton in Lake and Estuary Ecosystems,
W79-05739 5C

COMPUTER PROGRAMS
Flow Profiles in Trapezoidal Channels by Pocket Calculators,
W79-05538 8B

Proceedings of the First Membership Conference of the National Water Data Exchange, May 9-11, 1978, Denver, Colorado,
W79-05585 7C

Rapidly Obtaining Optimal Irrigation System Designs,
W79-05993 3F

Computer Model for Center Pivot Sprinkler Design,
W79-05994 3F

The Use of Computers to Nozzle Center Pivot Systems,
W79-05995 3F

COMPUTERS
Proceedings for Gathering Ground Truth Information for a Supervised Approach to a Computer-Implemented Land Cover Classification of Landsat-Acquired Multispectral Scanner Data,
W79-05859 7B

CONDENSATION
Dew and Thermal Lag: A Model for Cocoa Pods,
W79-05856 2B

Research on Condensation Mechanisms,
W79-05882 3A

CONFERENCES
Workshop on Copper in Estuarine, Continental and Marine Waters,
W79-05513 5C

Proceedings of the First Membership Conference of the National Water Data Exchange, May 9-11, 1978, Denver, Colorado,
W79-05585 7C

Fourth National Workshop on Entrainment and Impingement,
W79-05754 5C

CONGESTION
Congestion, Pollution, and Impure Public Goods,
W79-05748 6C

CONNECTICUT
Map Showing Drainage Areas, Columbia Quadrangle, Connecticut,
W79-05600 7C

Map Showing Drainage Areas, Norfolk Quadrangle, Connecticut,
W79-05601 7C

Map Showing Drainage Areas, New Britain Quadrangle, Connecticut,
W79-05602 7C

Map Showing Drainage Areas, Collinsville Quadrangle, Connecticut,
W79-05603 7C

COOK INLET
Lower Cook Inlet Meroplankton,
W79-05913 5C

Composition and Source Identification of Organic Detritus in Lower Cook Inlet,
W79-05925 5C

COOLING TOWERS
Evaluation of Proposed TG and E (Tucson Gas and Electric Company) Wastewater Discharge on Groundwater in the Tucson Basin,
W79-05519 5E

COOLING WATER
Process for Protecting Asbestos-Cement Bearing Surfaces in Recirculating Cooling Water Systems,
W79-05949 8F

COON LAKE (ONTARIO)
Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

COPPER
Workshop on Copper in Estuarine, Continental and Marine Waters,
W79-05513 5C

COPPER-NICKEL STUDY REGION (MINN)
Physiography and Surficial Geology of the Copper-Nickel Study Region, Northeastern Minnesota,
W79-05984 7C

CORN
Corn Yields from Irrigation with Adequate and Deficient Water,
W79-05803 3F

CORROSION
Corrosion of Metals in Sea Water,
W79-05870 3A

COST-BENEFIT ANALYSIS
The Cap - Who Needs It.
W79-05568 6B

Perils of the Orderly Mind: Cost-Benefit Analysis and Other Logical Pitfalls,
W79-05751 6B

An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

COSTS
Disposal of Saline Water Conversion Brines -- An Orientation Study,
W79-05657 3A

Preliminary Design of an Experimental Containerized Freeze Desalination Unit,
W79-05727 3A

COTTON
Effects of Water Management and Soil Physical Properties on Cotton Production in the Rolling Plains,
W79-05557 3F

CRESTED BUTTE COAL FIELD
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

CRITICAL HABITATS
The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

CROP PRODUCTION
A Note on the Economic Significance of Uniform Water Application,
W79-05816 3F

CROP RESPONSE
Corn Yields from Irrigation with Adequate and Deficient Water,
W79-05803 3F

Grapefruit Response to Variable Salinity in Irrigation Water and Soil,
W79-05814 3C

CROWLEY (TX)
Flood Plain Information: Deer Creek and Tributaries, Crowley, Texas.
W79-05720 2E

CULTIVATION
Biological Recovery Versus Desertization,
W79-05556 3B

CURRENTS (WATER)
Inertial Currents in Lake Ontario, Winter 1972-73 (IFYGL),
W79-05634 2H

Longshore Transport at a Total Littoral Barrier,
W79-05838 2H

CYANOPHYTA
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

CYCLING NUTRIENTS
Community Structure, Dynamics and Nutrients Cycling in the Okefenokee Cypress Swamp-Forest,
W79-05746 5C

CYPRESS TREES
Community Structure, Dynamics and Nutrients Cycling in the Okefenokee Cypress Swamp-Forest,
W79-05746 5C

DADE COUNTY
Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

DADE COUNTY (FL)
Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

DAM FOUNDATIONS
Review Report on Umpqua River and Tributaries, Oregon, Interim Report, South Umpqua River, Volume III; (Appendix B--Hydrology, Meteorology, and Reservoir Regulation; Appendix C--Foundation and Materials Data; Appendix D--Recreation, Public Use, and Environment),
W79-05616 8A

DAMS
Review Report on Umpqua River and Tributaries, Oregon, Interim Report, South Umpqua River, Volume III; (Appendix B--Hydrology, Meteorology, and Reservoir Regulation; Appendix C--Foundation and Materials Data; Appendix D--Recreation, Public Use, and Environment),
W79-05616 8A

DATA
An Outline of Soil, Water and Agriculture in Arab Countries,
W79-05553 2A

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-05890 5C

DATA COLLECTION
An Outline of Soil, Water and Agriculture in Arab Countries,
W79-05553 2A

DATA COLLECTIONS
Lake Erie Ice: Winter 1975-76,
W79-05615 2C

A Compendium of Lake and Reservoir Data Collected by the National Eutrophication Survey in the Central United States.
W79-05732 5C

A Compendium of Lake and Reservoir Data Compiled by the National Eutrophication Survey in the Western United States.
W79-05733 5C

Documentation of Data and Literature Relevant to the Assessment of Thermal Power Plant Cooling System Effects on Aquatic Environments,
W79-05784 5C

Quality of Selected Waters in Southern Maine.
W79-05832 5B

Classification of Evaluation of Flood Flow Frequency Estimation Techniques,
W79-05844 2E

Catalog of Alaskan Seabird Colonies,
W79-05902 5C

National Water Data Coordination in the United States,
W79-05971 7A

DATA PROCESSING
Proceedings of the First Membership Conference of the National Water Data Exchange, May 9-11, 1978, Denver, Colorado,
W79-05585 7C

DATA STORAGE AND RETRIEVAL
Documentation of Data and Literature Relevant to the Assessment of Thermal Power Plant Cooling System Effects on Aquatic Environments,
W79-05784 5C

DAYS CREEK DAM (OR)
Review Report on Umpqua River and Tributaries, Oregon, Interim Report, South Umpqua River, Volume III; (Appendix B--Hydrology, Meteorology, and Reservoir Regulation; Appendix C--Foundation and Materials Data; Appendix D--Recreation, Public Use, and Environment),
W79-05616 8A

DEER CREEK (TX)
Flood Plain Information: Deer Creek and Tributaries, Crowley, Texas.
W79-05720 2E

DEMINERALIZATION
Desalination by Electrosorption and Desorption,
W79-05575 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

Development of the Solvent Demineralization of Saline Water,
W79-05650 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Graphite Electrodes.
W79-05661 3A

DENITRIFICATION
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

DENSITY
Two-Dimensional Bubble Plumes,
W79-05539 8B

DEPRESSION STORAGE
Hydrology and Water Control on Large Plains,
W79-05526 2A

DEPTH-AREA-DURATION ANALYSIS
Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

DESALINATION
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

Bibliography of Publications on Compounds o Gas Hydrate Type,
W79-05572 10C

Research Investigations of Multiple-Effec Evaporation of Saline Waters by Steam fro Solar Radiation,
W79-05573 3A

Research on Vapor Reheat and Liquid-Liqui Heat Exchange,
W79-05574 3A

Desalination by Electrosorption and Desorptio
W79-05575 3A

The Minimum Requirements for Sea Water Co version Processes,
W79-05576 3A

Removal of Scale-Forming Compounds fro Sea Water,
W79-05578 3A

Investigation and Development of an Electroly ic System for the Conversion of Saline a Brackish Waters,
W79-05579 3A

Heat Transfer in the LTV Evaporator: An An ysis of Pilot Plant Data and Predictive Tec niques for Plant Operation and Design,
W79-05581 3A

Development of the Direct Freeze Separati Process,
W79-05644 3A

Potential Use of Converted Sea Water for I gation in Parts of California and Texas,
W79-05645 3A

Research on Forced-Circulation and Dropw Condensation Techniques for Improving H Transfer Rates for Vapor Compression Evapo tors,
W79-05646

Theoretical Studies of the Behavior of Ions in Aqueous Solutions of Mixed Electrolytes with Respect to Osmionic Operation,
W79-05647 3A

Part I: Survey of Physiological Mechanisms of Sodium and Chloride Ion Transport and Design of Experiment for Application to Demineralizing Saline Waters - Part II: Laboratory Evaluation of Use of Algae in Saline Water Conversion -- Phase I Final Report,
W79-05648 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

Development of the Solvent Demineralization of Saline Water,
W79-05650 3A

Design, Construction, Field Testing and Cost Analysis of an Experimental Electrodialysis Demineralizer for Brackish Waters,
W79-05651 3A

Annual Report (FY 1969) Freeport Test Facility and Vertical-Tube-Evaporator Test Bed Plant, Freeport, Texas,
W79-05652 3A

Research on Liquid-Liquid Extraction for Saline Water Conversion,
W79-05654 3A

Demineralization of Saline Waters: A Preliminary Discussion of a Research Program,
W79-05655 3A

The Properties of Gas Hydrates and Their Use in Demineralizing Sea Water,
W79-05656 3A

Producing Selectively Infrared-Reflecting Surfaces on Plastic Films for Solar Stills,
W79-05659 3A

Development of Plastics Solar Stills.
W79-05660 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Graphite Electrodes.
W79-05661 3A

First Annual Report: Saline Water Conversion Plant No 1, Freeport, Texas.
W79-05662 3A

A Study of Large Size Saline Water Conversion Plants.
W79-05663 3A

Investigation of Chelation as a Means of Removing Ions from Sea Water,
W79-05868 3A

A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

Corrosion of Metals in Sea Water,
W79-05870 3A

A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

Investigation of Supersaturation in Saline Water Conversion,
W79-05872 3A

Vapor Compression with Secondary Heat-Transfer Media.
W79-05873 3A

Evaluation of a Thin-Film Sea Water Distillation Unit for Marine and Shore Base Application.
W79-05874 3A

Research on Thermoelectric Heat Pumps,
W79-05875 3A

Demineralization by Transport Depletion,
W79-05876 3A

An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

The Mechanism of Desalination by Reverse Osmosis,
W79-05878 3A

Study of Oriented Cellulose Membranes for Reverse Osmosis and the Relationship Between Morphology and Salt Rejection,
W79-05879 3A

Saline Water Conversion by Freezing: An Intergral Processing Unit Using a Secondary Refrigerant,
W79-05880 3A

Research on Salt Water Purification by Freezing,
W79-05881 3A

Research on Condensation Mechanisms,
W79-05882 3A

Seawater Distillation Apparatus,
W79-05958 3A

DESALINATION APPARATUS

Research on Vapor Reheat and Liquid-Liquid Heat Exchange,
W79-05574 3A

Investigation and Development of an Electrolytic System for the Conversion of Saline and Brackish Waters,
W79-05579 3A

Research on Liquid-Liquid Extraction for Saline Water Conversion,
W79-05654 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Graphite Electrodes.
W79-05661 3A

Preliminary Design of an Experimental Containerized Freeze Desalination Unit,
W79-05727 3A

A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

Evaluation of a Thin-Film Sea Water Distillation Unit for Marine and Shore Base Application.
W79-05874 3A

Research on Thermoelectric Heat Pumps,
W79-05875 3A

An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

Saline Water Conversion by Freezing: An Intergral Processing Unit Using a Secondary Refrigerant,
W79-05880 3A

DESALINATION PLANTS

Saline Water Conversion Demonstration Plant, Webster, South Dakota: First Annual Report,
W79-05577 3A

Annual Report (FY 1969) Freeport Test Facility and Vertical-Tube-Evaporator Test Bed Plant, Freeport, Texas,
W79-05652 3A

First Annual Report: Saline Water Conversion Plant No 1, Freeport, Texas.
W79-05662 3A

A Study of Large Size Saline Water Conversion Plants.
W79-05663 3A

DESALINATION PROCESSES

Research Investigations of Multiple-Effect Evaporation of Saline Waters by Steam from Solar Radiation,
W79-05573 3A

Research on Vapor Reheat and Liquid-Liquid Heat Exchange,
W79-05574 3A

The Minimum Requirements for Sea Water Conversion Processes,
W79-05576 3A

Demineralization of Saline Water Through Pressurization Cycles with Ion Exchange Materials,
W79-05580 3A

Heat Transfer in the LTV Evaporator: An Analysis of Pilot Plant Data and Predictive Techniques for Plant Operation and Design,
W79-05581 3A

Development of the Direct Freeze Separation Process,
W79-05644 3A

Research on Forced-Circulation and Dropwise Condensation Techniques for Improving Heat Transfer Rates for Vapor Compression Evaporators,
W79-05646 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

Development of the Solvent Demineralization of Saline Water,
W79-05650 3A

Freezing Process Studies,
W79-05653 3A

Research on Liquid-Liquid Extraction for Saline Water Conversion,
W79-05654 3A

Demineralization of Saline Waters: A Preliminary Discussion of a Research Program,
W79-05655 3A

Producing Selectively Infrared-Reflecting Surfaces on Plastic Films for Solar Stills,
W79-05659 3A

Development of Plastics Solar Stills.
W79-05660 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Graphite Electrodes.
W79-05661 3A

First Annual Report: Saline Water Conversion Plant No 1, Freeport, Texas.
W79-05662 3A

A Study of Large Size Saline Water Conversion Plants.
W79-05663 3A

Research on Role of Ligand Molecules on Ionization Potentials,
W79-05864 3A

A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

Vapor Compression with Secondary Heat-Transfer Media.
W79-05873 3A

Research on Thermoelectric Heat Pumps,
W79-05875 3A

Demineralization by Transport Depletion,
W79-05876 3A

An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

Saline Water Conversion by Freezing: An Intergral Processing Unit Using a Secondary Refrigerant,
W79-05880 3A

Research on Salt Water Purification by Freezing,
W79-05881 3A

Seawater Distillation Apparatus,
W79-05958 3A

DESALINATION WASTES
Disposal of Saline Water Conversion Brines -- An Orientation Study,
W79-05657 3A

DESCALING
Removal of Scale-Forming Compounds from Sea Water,
W79-05578 3A

DESERTIFICATION
Traditional Perceptabilities (Sic.) of Environment and Desertification: A Case Study,
W79-05562 6B

DESIGN
Preliminary Design of an Experimental Containerized Freeze Desalination Unit,
W79-05727 3A

DESIGN CRITERIA
A Study of Large Size Saline Water Conversion Plants.
W79-05663 3A

DETRITIVORES
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

DETRITUS
Composition and Source Identification of Organic Detritus in Lower Cook Inlet,
W79-05925 5C

DEVELOPING COUNTRIES
Economics of Water Development in Less Developed Countries,
W79-05750 6B

DEW
Dew and Thermal Lag: A Model for Cocoa Pods,
W79-05856 2B

DEW POINT
Dew and Thermal Lag: A Model for Cocoa Pods,
W79-05856 2B

DEWATERING
Sludge-Dewatering Techniques Must Meet Pollution Control Requirements,
W79-05506 5E

DIATOMS
The Culture of the Diatom Chaetoceros Gracilis and Its Use as a Food for Penaeid Protozoeal Larvae,
W79-05738 5C

The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

DIRECT FREEZE SEPARATION PROCESS
Development of the Direct Freeze Separation Process,
W79-05644 3A

DISPERSION
Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

DISSOLVED OXYGEN
Oxygen Depletion in the New York Bight Apex: Causes and Consequences,
W79-05694 5B

Predicting Nighttime Oxygen Depletion in Catfish Ponds,
W79-05800 2H

Modeling Nitrogen, Oxygen, Chattahoochee River, GA.,
W79-05974 5B

DISTRIBUTION
Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

DISTRIBUTION PATTERNS
Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

DRAG
Drag Reduction in Sewers: First Results from a Permanent Installation,
W79-05543 8B

DRAINAGE AREA
Map Showing Drainage Areas, Columbia Quadrangle, Connecticut,
W79-05600 7C

Map Showing Drainage Areas, Norfolk Quadrangle, Connecticut,
W79-05601 7C

Map Showing Drainage Areas, Collinsville Quadrangle, Connecticut,
W79-05603 7C

DRAINAGE EFFECTS
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

DRAINAGE ENGINEERING
Land and Water Use in Saudi Arabia,
W79-05561 5G

DRANAGE AREA
Map Showing Drainage Areas, New Britain Quadrangle, Connecticut,
W79-05602 7C

DREDGED MATERIAL
Granular Media Filtration of Dredging Effluents,
W79-05621 5A

DREDGING
Granular Media Filtration of Dredging Effluents,
W79-05621 5A

DRILLING EQUIPMENT
Clamp-On Drilling Centralizer Permits Precise Direction Control,
W79-05999 8A

Welding Still Widely Used in Drilling Industry,
W79-06000 8A

DROPWISE CONDENSATION
Research on Forced-Circulation and Dropwise Condensation Techniques for Improving Heat Transfer Rates for Vapor Compression Evaporators,
W79-05646 3A

DROUGHTS
The Relationship Between Economic Development and Ecological Degradation: How Degradation has Occurred in West Africa and How Its Progress Might be Halted,
W79-05565 6B

Assessment of Weather Modification in Alleviating Agricultural Water Shortages During Droughts,
W79-05836 2B

DUMONTIA INCRASSATA
Ecological Studies of the Annual Red Alga Dumontia Ncrassata (O.F. Muller) Lamouroux,
W79-05618 5C

DUNE SANDS
Predicting Sand Deposition at Porous Fences,
W79-05533 2J

DUST STORMS
Dust Storms and Their Geomorphological Implications,
W79-05559 2J

DYE DISPERSION
Dye-Dispersion Study at Proposed Pumped-Storage Project on Hudson River at Cornwall-on-the-Hudson, New York,
W79-05596 5B

EARTH DAMS
Earth Dams and Reservoirs,
W79-05612 2H

EARTH-WATER INTERFACES
Arid Geomorphology,
W79-05558 2J

ECOLOGICAL DISTRIBUTION
Baseline Characterization of Marine Mammals in the Bering Sea: Distribution and Abundance,
W79-05665 5C

Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

Studies of Marine Birds on Ugaiushak Island,
W79-05896 5C

Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

Plant Communities of Alaskan Arctic Beaches,
W79-05910 5C

Report on Zooplankton Community Grazing Experiments Conducted on Board the NOAA Ship, Discoverer, in the Bering Sea, May-June 1977,
W79-05918 5C

OLOGY
Ecological Studies of the Annual Red Alga Dumontia Ncrassata (O.F. Muller) Lamouroux,
W79-05618 5C

Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha India),
W79-05630 5C

Biology of the Harbor Seal, Phoca Vitulina Richardi, in the Gulf of Alaska,
W79-05669 5C

The Natural History and Ecology of the Bearded Seal (Erignathus Barbatus) and the Ringed Seal (Phoca Hispida),
W79-05670 5C

Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

An Amendment to RU232 Trophic Relationships Among Ice Inhabiting Phocid Seals, and RU230 Natural History of Ringed and Bearded Seals,
W79-05672 5C

Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-05890 5C

Ecological Studies in the Northern Bering Sea: Studies of Seabirds in the Bering Strait,
W79-05891 5C

Ecological Studies of Colonial Seabirds at Cape Thompson and Cape Lisburne, Alaska,
W79-05892 5C

Studies of Marine Birds on Ugaiushak Island,
W79-05896 5C

The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

The Distribution, Abundance, Diversity and Productivity of the Western Beaufort Sea Benthos,
W79-05906 5C

Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

Effects of Petroleum Exposure on the Breeding Ecology of the Gulf of Alaska Herring Gull Group and Reproductive Ecology of Large Gulls in the Northeast Gulf of Alaska,
W79-05923 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Avian Ecology in Simpson Lagoon, 1977,
W79-05928 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Ecology of Fishes in Simpson Lagoon, 1977,
W79-05929 5C

ECONOMIC FEASIBILITY
The Cap - Who Needs It.
W79-05568 6B

A Study of Large Size Saline Water Conversion Plants.
W79-05663 3A

Investigation of Chelation as a Means of Removing Ions from Sea Water,
W79-05868 3A

ECONOMIC IMPACT
Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

ECONOMIC JUSTIFICATION
The Relationship Between Economic Development and Ecological Degradation: How Degradation has Occurred in West Africa and How Its Progress Might be Halted,
W79-05565 6B

ECONOMICS
Congestion, Pollution, and Impure Public Goods,
W79-05748 6C

Standard Setting and the Theory of Institutional Choice: The Case of Pollution Control,
W79-05749 6C

Perils of the Orderly Mind: Cost-Benefit Analysis and Other Logical Pitfalls,
W79-05751 6B

A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

ECONONICS
Economics of Water Development in Less Developed Countries,
W79-05750 6B

ECOSYSTEMS
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

A Conceptual Representation of the New York Bight Ecosystem,
W79-05696 5B

The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

Catalog of Alaskan Seabird Colonies,
W79-05902 5C

Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

Beaufort Sea Plankton Studies,
W79-05912 5C

Bering Sea Ice Edge Ecosystem Study: Nutrient Cycling and Organic Matter Transfer,
W79-05917 5C

Report on Zooplankton Community Grazing Experiments Conducted on Board the NOAA Ship, Discoverer, in the Bering Sea, May-June 1977,
W79-05918 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Ecology of Fishes in Simpson Lagoon, 1977,
W79-05929 5C

EFFICIENCIES
Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

EFFLUENTS
Granular Media Filtration of Dredging Effluents,
W79-05621 5A

Investigation of Supersaturation in Saline Water Conversion,
W79-05872 3A

EGLIN AIR FORCE BASE (FL)
Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida,
W79-05839 5C

ELECTRIC POWER INDUSTRY
Regulatory Developments in Section 316(b),
W79-05757 5C

ELECTRIC POWER PRODUCTION
The Effect of Water Pollution Control Regulations on the Cost of Production of Electric Power,
W79-05796 6B

ELECTRODES
Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

ELECTRODIALYSIS
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

Saline Water Conversion Demonstration Plant, Webster, South Dakota: First Annual Report,
W79-05577 3A

Design, Construction, Field Testing and Cost Analysis of an Experimental Electrodialysis Demineralizer for Brackish Waters,
W79-05651 3A

Investigation of Supersaturation in Saline Water Conversion,
W79-05872 3A

ELECTROLYTES
The Study of Ionic Solvation,
W79-05658 1A

ELECTROSORPTION
Desalination by Electrosorption and Desorption,
W79-05575 3A

ELY CREEK
Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6D

EMBANKMENTS
Earth Dams and Reservoirs,
W79-05612 2H

ENDOPHYTES
An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

ENERGY
Wave Forces on Cylinders Near Plane Boundaries,
W79-05532 2L

The Minimum Requirements for Sea Water Conversion Processes,
W79-05576 3A

Water and Energy in the Western Coal Lands,
W79-05845 6D

Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation,
W79-05885 5C

Nutrient Dynamics in Nearshore Under-Ice Waters,
W79-05920 5C

ENERGY CONVERSION
The Minimum Requirements for Sea Water Conversion Processes,
W79-05576 3A

ENERGY LOSS
The Minimum Requirements for Sea Water Conversion Processes,
W79-05576 3A

ENGINEERING
Fisheries Issues Related to Water Development in the Sacramento-San Joaquin Estuary, California,
W79-05789 6G

ENGINEERING STRUCTURES
Engineering Implications of New Fish Screening Concepts,
W79-05785 8I

Multifarious Power Plant Water Intake Structure: A Design to Reduce Impingement and Entrainment Mortality,
W79-05786 8I

Preliminary Studies on the Operating Aspects of Small Slot Width Wedgewire Screens with Conceptual Designs for Power Station Use,
W79-05787 8I

A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish,
W79-05788 8I

Present Engineering Limitations to the Protection of Fish at Water Intakes,
W79-05790 8I

ENGLAND
The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

Persistence and Orographic Modulation of Mesoscale Precipitation Areas in a Potentially Unstable Warm Sector,
W79-05855 2B

ENTRAINMENT
Entrainment Impact Estimates Using the Equivalent Adult Approach,
W79-05516 5C

Fourth National Workshop on Entrainment and Impingement,
W79-05754 5C

Evaluation of Ichthyoplankton Sampling Gear Used in Power Plant Entrainment Studies,
W79-05759 5C

Entrainment of Missouri River Fish Larvae Through Fort Calhoun Station,
W79-05760 5C

Mortality of Young Striped Bass Entrained at Two Power Plants in the Sacramento-San Joaquin Delta, California,
W79-05761 5C

Survival of Entrained Ichthyoplankton and Macroinvertebrates at Hudson River Power Plants,
W79-05762 5C

Survival of Planktonic Organisms Following Passage Through a Simulated Power Plant Condenser Tube,
W79-05763 5C

Models Useful for the Estimation of Equilibrium Population Reduction Due to Power Plant Cropping,
W79-05764 5C

A Method for Determining Growth and Mortality Rates of Ichthyoplankton,
W79-05765 5C

Effects of the Donald C. Cook Nuclear Power Plant on Zooplankton of Southeastern Lake Michigan,
W79-05766 5C

Entrainment of Crustacean Zooplankton Through Fort Calhoun Station,
W79-05767 5C

Macroinvertebrate Entrainment Study at Fort Calhoun Station,
W79-05768 5C

Effects of Acute Thermal Stress on Marine Fish Embryos and Larvae,
W79-05769 5C

Impacts of Three Types of Power Generating Discharge Systems on Entrained Plankton,
W79-05770 5C

Mortalities of the Larvae of Two Species of Bivalves after Acute Exposure to Elevated Temperature,
W79-05771 5C

An Approach for the Analysis of Striped Bass Entrainment Survival at Hudson River Power Plants,
W79-05782 5C

Present Engineering Limitations to the Protection of Fish at Water Intakes,
W79-05790 8I

ENVIRONMENTAL ASSESSMENTS
The Perception and Valuation of Water Quality: A Review of Research Method and Findings,
W79-05723 6B

ENVIRONMENTAL EFFECTS
Major Passage Problems,
W79-05509 5C

Corps of Engineers Responsibilities and Actions to Maintain Columbia Basin Anadromous Fish Runs,
W79-05510 5C

The Mid-Columbia Public Utility Responsibility,
W79-05511 5C

The Importance of Water Quality to Columbia River Salmon and Steelhead,
W79-05512 5C

Workshop on Copper in Estuarine, Continental and Marine Waters,
W79-05513 5C

Ecological Bioenergetics of Physa Acuta (Gastropoda) in Heated Waters,
W79-05514 5C

The Recovery and Hematological Rehabilitation of Chlorine Stressed Adult Rainbow Trout (Salmo Gairdneri),
W79-05515 5C

Entrainment Impact Estimates Using the Equivalent Adult Approach,
W79-05516 5C

Dust Storms and Their Geomorphological Implications,
W79-05559 2J

Traditional Perceptabilities (Sic.) of Environment and Desertification: A Case Study,
W79-05562 6E

Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

Patterns of Algal Succession in a Perturbated Marine Intertidal Community,
W79-05664 5C

Baseline Characterization of Marine Mammals in the Bering Sea: Distribution and Abundance
W79-05665 5C

Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska,
W79-05666 5C

Morbidity and Mortality of Marine Mammals
W79-05668 5C

Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5C

Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5

Spatial and Temporal Variation in Sedimentary Grain-Size Facies and Sediment Heavy Metal Ratios in the New York Bight Apex,
W79-05686 5

Suspended Particulate Concentrations and Compositions in the New York Bight,
W79-05687 5

Effects of Coastal Pollution on Fish and Fisheries--With Particular Reference to the Middle Atlantic Bight,
W79-05699 5

Some Results of Fish Surveys in the Mid-Atlantic Important For Assessing Environmental Impacts,
W79-05701 5

Fin Rot Disease Studies in the New York Bight
W79-05702 5

Perils of the Orderly Mind: Cost-Benefit Analysis and Other Logical Pitfalls,
W79-05751 6B

Implementation of Section 316 of the Federal Water Pollution Control Act,
W79-05755 5C

The Power Plant Regulatory Program: A Congressional Dilimma,
W79-05756 5C

Regulatory Developments in Section 316(b),
W79-05757 5C

The Role of the Scientist in the Section 316 Process: A Lawyer's Point of View,
W79-05758 5C

Evaluation of Ichthyoplankton Sampling Gear Used in Power Plant Entrainment Studies,
W79-05759 5C

Entrainment of Missouri River Fish Larvae Through Fort Calhoun Station,
W79-05760 5C

Mortality of Young Striped Bass Entrained at Two Power Plants in the Sacramento-San Joaquin Delta, California,
W79-05761 5C

Survival of Entrained Ichthyoplankton and Macroinvertebrates at Hudson River Power Plants,
W79-05762 5C

Survival of Planktonic Organisms Following Passage Through a Simulated Power Plant Condenser Tube,
W79-05763 5C

Models Useful for the Estimation of Equilibrium Population Reduction Due to Power Plant Cropping,
W79-05764 5C

A Method for Determining Growth and Mortality Rates of Ichthyoplankton,
W79-05765 5C

Effects of the Donald C. Cook Nuclear Power Plant on Zooplankton of Southeastern Lake Michigan,
W79-05766 5C

Entrainment of Crustacean Zooplankton Through Fort Calhoun Station,
W79-05767 5C

Macroinvertebrate Entrainment Study at Fort Calhoun Station,
W79-05768 5C

Effects of Acute Thermal Stress on Marine Fish Embryos and Larvae,
W79-05769 5C

Impacts of Three Types of Power Generating Discharge Systems on Entrained Plankton,
W79-05770 5C

Mortalities of the Larvae of Two Species of Bivalves after Acute Exposure to Elevated Temperature,
W79-05771 5C

Impingement Survival Studies on White Perch, Striped Bass, and Atlantic Tomcod at Three Hudson River Power Plants,
W79-05772 5C

Survival of Fishes and Macroinvertebrates Impinged at Oyster Creek Generating Station,
W79-05773 5C

An Analysis of Factors Influencing the Impingement of Threadfin Shad at Power Plants in the Southeastern United States,
W79-05774 5C

Comparative Fish Impingement at Two Adjacent Water Intakes on the Mid-Columbia River,
W79-05775 5C

Statistical Comparison and Choices of Sampling Designs for Estimating Fish Impingement at Cooling Water Intakes,
W79-05776 5C

Temporally Stratified Sampling Programs for Estimation of Fish Impingement,
W79-05777 5C

A Conceptual Model of Causal Factors Regarding Gizzard Shad Runs at Steam Electric Power Plants,
W79-05778 5C

Effect of Environmental Variables on Fish Impingement,
W79-05779 5C

Possibilities for Assessment of the Effects of Power Plant Operation at the Ecosystem Level,
W79-05780 5C

A Mathematical Model of the Interactions of an Aquatic Ecosystem and a Thermal Power Station Cooling System,
W79-05781 5C

An Approach for the Analysis of Striped Bass Entrainment Survival at Hudson River Power Plants,
W79-05782 5C

Perspectives on Fish Impingement,
W79-05783 5C

Documentation of Data and Literature Relevant to the Assessment of Thermal Power Plant Cooling System Effects on Aquatic Environments,
W79-05784 5C

Engineering Implications of New Fish Screening Concepts,
W79-05785 8I

Fisheries Issues Related to Water Development in the Sacramento-San Joaquin Estuary, California,
W79-05789 6G

Present Engineering Limitations to the Protection of Fish at Water Intakes,
W79-05790 8I

Impacts of Recreation on Riparian Soils and Vegetation,
W79-05843 4C

Ecological Studies of Colonial Seabirds at Cape Thompson and Cape Lisburne, Alaska,
W79-05892 5C

Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

Studies of Marine Birds on Ugaiushak Island,
W79-05896 5C

The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Avian Ecology in Simpson Lagoon, 1977,
W79-05928 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

ENVIRONMENTAL ENGINEERING

Traditional Perceptabilities (Sic.) of Environment and Desertification: A Case Study,
W79-05562 6B

ENVIRONMENTAL IMPACT

Evaluation of Proposed TG and E (Tucson Gas and Electric Company) Wastewater Discharge on Groundwater in the Tucson Basin,
W79-05519 5E

Growth Effects of Major Land Use Projects (Wastewater Facilities), Volume I: Model Specification and Causal Analysis,
W79-05866 6G

EQUATIONS

Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

EQUILIBRIUM

Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

EROSION

Developmental Tests on the Use of Fluorescent Tracers and Backwash Sediment-Load Samplers to Measure the Beach Drift Component of Littoral Transport at Sandy Hook, New Jersey,
W79-05688 2J

Nutrient Dynamics in Nearshore Under-Ice Waters,
W79-05920 5C

EROSION CONTROL

Predicting Sand Deposition at Porous Fences,
W79-05533 2J

EROSION RATES

Dust Storms and Their Geomorphological Implications,
W79-05559 2J

ESTUARIES

Estuarine Research: An Annotated Bibliography of Selected Literature, With Emphasis on the Hudson River Estuary, New York and New Jersey,
W79-05593 2L

Distribution of Suspended Bacteria in the Newport River Estuary, North Carolina,
W79-05623 2L

The Modeling of Tidal Flow in a Channel Using a Turbulence Energy Closure Scheme,
W79-05637 2L

Mathematical Model and Computer Simulation of the Population Dynamics of Zooplankton in Lake and Estuary Ecosystems,
W79-05739 5C

Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

Detection of Heavy Metal Pollution in Estuarine Sediments,
W79-05850 5B

The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

ESTUARINE ENVIRONMENTS
Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

EUROPE
Problems of the Periglacial Zone (Zagadnienia Strefy Peryglacjalnej),
W79-05545 2C

Regional Mean Bowen Ratios Deduced from Diurnal Changes of Temperature and Humidity,
W79-05883 2A

EUTROPHICATION
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

Cultivating and Harvesting Algae to Forestall Accelerated Eutrophication,
W79-05584 5C

Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

A Compendium of Lake and Reservoir Data Collected by the National Eutrophication Survey in the Central United States.
W79-05732 5C

A Compendium of Lake and Reservoir Data Compiled by the National Eutrophication Survey in the Western United States.
W79-05733 5C

A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

Chemistry of Phosphorus, Cadmium, Copper, Nickel, Lead, and Zinc in Indiana Lake and Reservoir Sediments,
W79-05794 5B

A Review of Phytoplankton Studies in Lake Livingston, Texas,
W79-05806 5C

EVALUATION
Saline Water Conversion Demonstration Plant, Webster, South Dakota: First Annual Report,
W79-05577 3A

EVAPORATION
Research on Forced-Circulation and Dropwise Condensation Techniques for Improving Heat Transfer Rates for Vapor Compression Evaporators,
W79-05646 3A

An Analytical Model of Rainfall Interception by Forests,
W79-05854 2D

EVAPOTRANSPIRATION
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

Comparison of Evapotranspiration Rates in the Platte River in Nebraska: 1938 vs 1978,
W79-05798 2D

EXPLOSIVES
The Care of Explosives,
W79-05998 8H

EXTERNALITIES
Congestion, Pollution, and Impure Public Goods,
W79-05748 6C

FABRICATION
The Mechanism of Desalination by Reverse Osmosis,
W79-05878 3A

FAIRFAX COUNTY
Flood-Plain Delineation for Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, and Thompson Creek, Fairfax County, Virginia,
W79-05986 6A

FALLOUT
Wet and Dry Deposition of Nutrients in Central Alberta,
W79-05849 5B

FEDERAL WATER POLLUTION CONTROL ACT
Nonpoint Source Pollution,
W79-05582 5B

FEEDING GROUNDS
Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

FEEDING HABITS
The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

FERTILIZERS
Removal of Scale-Forming Compounds from Sea Water,
W79-05578 3A

FILTRATION
Granular Media Filtration of Dredging Effluents,
W79-05621 5A

Membrane Processes for Environmental Studies,
W79-05735 5D

Method and Apparatus for Removing Filterable Substances from a Liquid,
W79-05955 5D

FIN ROT DISEASE
Fin Rot Disease Studies in the New York Bight,
W79-05702 5C

FISH
Effects of Coastal Pollution on Fish and Fisheries--With Particular Reference to the Middle Atlantic Bight,
W79-05699 5C

Some Results of Fish Surveys in the Mid-Atlantic Important For Assessing Environmental Impacts,
W79-05701 5C

Evaluation of Planning for Fish and Wildlife, Lake Sharpe Reservoir Project,
W79-05717 6G

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Overview and Synthesis,
W79-05927 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Ecology of Fishes in Simpson Lagoon, 1977,
W79-05929 5C

FISH DISEASES
Fin Rot Disease Studies in the New York Bight,
W79-05702 5C

Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea,
W79-05916 5C

FISH EGGS
Chromosome Mutagenesis in Developing Mackerel Eggs Sampled from the New York Bight,
W79-05703 5C

FISH PASSAGES
Major Passage Problems,
W79-05509 5C

Corps of Engineers Responsibilities and Actions to Maintain Columbia Basin Anadromous Fish Runs,
W79-05510 5C

The Mid-Columbia Public Utility Responsibility,
W79-05511 5C

FISHERIES
Effects of Coastal Pollution on Fish and Fisheries--With Particular Reference to the Middle Atlantic Bight,
W79-05699 5C

Middle Atlantic Fisheries: Recent Changes in Populations and Outlook,
W79-05700 5C

Lower Cook Inlet Meroplankton,
W79-05913 5C

Composition and Source Identification of Organic Detritus in Lower Cook Inlet,
W79-05925 5C

FISHES
Lower Cook Inlet Meroplankton,
W79-05913 5C

FJORDS
Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

FLOOD BOUNDARY MAPS
Flood-Plain Delineation for Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, and Thompson Creek, Fairfax County, Virginia,
W79-05986 6A

FLOOD CONTROL
Application of Hydraulic and Hydrologic Data in Urban Stormwater Management,
W79-05588 6A

FLOOD FORECASTING
Application of Hydraulic and Hydrologic Data in Urban Stormwater Management,
W79-05588 6A

Flood-Plain Delineation for Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, and Thompson Creek, Fairfax County, Virginia,
W79-05986 6A

FLOOD FREQUENCY
Classification of Evaluation of Flood Flow Frequency Estimation Techniques,
W79-05844 2E

FLOOD PLAIN MANAGEMENT
Flood Plain Information: Maxwell Creek, Parker, Texas,
W79-05719 2E

Flood Plain Information: Deer Creek and Tributaries, Crowley, Texas.
W79-05720 2E

FLOOD PLAIN SIMULATION FACILITY (MS)
A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

FLOOD PLAINS
A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

Flood-Plain Delineation for Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, and Thompson Creek, Fairfax County, Virginia,
W79-05986 6A

FLOOD PROFILES
Flood Plain Information: Deer Creek and Tributaries, Crowley, Texas.
W79-05720 2E

Flood-Plain Delineation for Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, and Thompson Creek, Fairfax County, Virginia,
W79-05986 6A

FLOOD PROTECTION
Special Flood Hazard Information: Turkey Creek, Bryan, Texas.
W79-05716 2E

Flood Plain Information: Maxwell Creek, Parker, Texas,
W79-05719 2E

Flood Plain Information: Deer Creek and Tributaries, Crowley, Texas.
W79-05720 2E

FLOOD RECURRENCE INTERVAL
Flood-Plain Delineation for Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, and Thompson Creek, Fairfax County, Virginia,
W79-05986 6A

FLOOD ROUTING
Simplified Muskingum Routing Equation,
W79-05536 2E

Translatory Characteristics of the Muskingum Method of Flood Routing,
W79-05941 2E

FLOOD STAGES
Flood Plain Information: Maxwell Creek, Parker, Texas,
W79-05719 2E

Flood Plain Information: Deer Creek and Tributaries, Crowley, Texas.
W79-05720 2E

FLOOD WAVES
Simplified Muskingum Routing Equation,
W79-05536 2E

Translatory Characteristics of the Muskingum Method of Flood Routing,
W79-05941 2E

FLOODING
Special Flood Hazard Information: Turkey Creek, Bryan, Texas.
W79-05716 2E

Biological Hydrolysis of Parathion in Natural Ecosystems,
W79-05935 5B

Metabolism of Nitrophenols in Flooded Soils,
W79-05936 5A

FLOODS
Application of Hydraulic and Hydrologic Data in Urban Stormwater Management,
W79-05588 6A

A Study of Large Floods in the Thambraparani River in Tamil Nadu,
W79-05629 2E

Special Flood Hazard Information: Turkey Creek, Bryan, Texas.
W79-05716 2E

Flood Plain Information: Maxwell Creek, Parker, Texas,
W79-05719 2E

Flood Plain Information: Deer Creek and Tributaries, Crowley, Texas.
W79-05720 2E

Translatory Characteristics of the Muskingum Method of Flood Routing,
W79-05941 2E

FLORIDA
Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

Geologic and Geophysical Data from Osceola National Forest, Florida,
W79-05605 5A

Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

Effluent Irrigation of Coastal Bermuda Grass,
W79-05624 3C

Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida,
W79-05839 5C

Detection of Heavy Metal Pollution in Estuarine Sediments,
W79-05850 5B

Application of Ridge Regression Analysis to Water Resources Studies,
W79-05853 2A

Effects of Land Use and Water Management on Water Quality in the Western South New River Canal Basin, Southeast Florida, 1974-75,
W79-05978 4C

Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

FLORIDAN AQUIFER
Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

FLOW CONTROL
Cam-Lock Water Gate,
W79-05951 8C

FLUTED-TUBE WIPED FILM EVAPORATOR
Evaluation of a Thin-Film Sea Water Distillation Unit for Marine and Shore Base Application.
W79-05874 3A

FLUVIAL SEDIMENTS
Dust Storms and Their Geomorphological Implications,
W79-05559 2J

FLY ASH
Growth and Elemental Composition of Corn and Bean Seedlings as Influenced by Soil Application of Coal Ash,
W79-05942 5B

FOOD CHAIN
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

FOOD CHAINS
The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

FOOD HABITS
Importance of Algae in the Diet of the Oligochaetes Lumbriculus Variegatus (Muller) and Rhyacodrulus Sodalis (Eisen),
W79-05517 5C

Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

FOOD PROCESSING INDUSTRY
Removing Coagulable Substances from an Aqueous Medium,
W79-05956 5D

FOOD SUPPLY
Breeding and Population Ecology of Fulmars at Semidi Islands, Alaska, with Observations on the Reproduction of Sympatric Seabird Species,
W79-05895 5C

The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

FOODS
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. II: Feeding Habits of Birds in the Beaufort Sea,
W79-05677 5C

FOREST FIRES
Stream Chemistry and Watershed Nutrient Economy Following Wildfire and Fertilization in Eastern Washington,
W79-05824 5B

FORESTS
An Analytical Model of Rainfall Interception by Forests,
W79-05854 2D

FRAMEWORK MODEL
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

A Demonstration of Areawide Water Resources Planning--Users Manual,
W79-05715 6A

FREEZING
Freezing Process Studies,
W79-05653 3A

Preliminary Design of an Experimental Containerized Freeze Desalination Unit,
W79-05727 3A

A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

Saline Water Conversion by Freezing: An Intergral Processing Unit Using a Secondary Refrigerant,
W79-05880 3A

Research on Salt Water Purification by Freezing,
W79-05881 3A

FUMIGANTS
Effects of SO2 and NO2 on Nitrification in Soil,
W79-05940 5B

FUTURE PLANNING (PROJECTED)
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

GAME BIRDS
Evaluation of Planning for Fish and Wildlife, Lake Sharpe Reservoir Project,
W79-05717 6G

GARFIELD COUNTY
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

GELIDIELLA ACEROSA
Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

GENERALIZED ESTIMATES
Probable Maximum Precipitation Estimates, United States East of the 105th Meridian,
W79-05863 2B

GEOLOGIC HISTORY
Problems of the Periglacial Zone (Zagadnienia Strefy Peryglacjalnej),
W79-05545 2C

GEOLOGY
Physiography and Surficial Geology of the Copper-Nickel Study Region, Northeastern Minnesota,
W79-05984 7C

GEOMORPHOLOGY
Arid Geomorphology,
W79-05558 2J

Dust Storms and Their Geomorphological Implications,
W79-05559 2J

Physiography and Surficial Geology of the Copper-Nickel Study Region, Northeastern Minnesota,
W79-05984 7C

GEORGIA
Ground-Water Levels and Quality Data for Georgia, 1977,
W79-05607 4B

GLACIATION
Problems of the Periglacial Zone (Zagadnienia Strefy Peryglacjalnej),
W79-05545 2C

GLACIERS
Effect of Climatic Warming on the West Antarctic Ice Sheet,
W79-05528 2C

GLACIOLOGY
Climatic Roles of Ice: A Contribution to the International Hydrological Programme (IHP),
W79-05527 2C

GOTEBORG (SWEDEN)
Local Infiltration of Storm Water,
W79-05550 4A

GRAND HOGBACK COAL FIELD
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

GRAVELS
Concentration and Size of Gravel in Relation to Neutron Moisture and Density Probe Calibration,
W79-05530 7B

GRAZING
Biological Recovery Versus Desertization,
W79-05556 3B

GREAT BRITAIN
An Analytical Model of Rainfall Interception by Forests,
W79-05854 2D

GREAT LAKES
Analysis of Cool Season Lake-Related Mesoscale Phenomena Using Numerical Variational Analysis,
W79-05523 2B

Inertial Currents in Lake Ontario, Winter 1972-73 (IFYGL),
W79-05634 2H

A Three-Dimensional Model of Lake Ontario's Summer Circulation, II. A Diagnostic Study,
W79-05635 2H

Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

GREAT SLAVE LAKE (NORTHWEST TERRITORIES)
Importance of Algae in the Diet of the Oligochaetes Lumbriculus Variegatus (Muller) and Rhyacodrulus Sodalis (Eisen),
W79-05517 5C

GREEN RIVER BASIN
Water Resources Data for Wyoming, Water Year 1977--Volume 2. Green River Basin, Bear River Basin, Snake River Basin,
W79-05599 7C

GROUNDWATER
Groundwater Sampling in Uranium Reconnaissance,
W79-05521 5A

Geohydrological Research at the Chalmers University of Technology, Goteborg.
W79-05546 4C

Swedish Urban Hydrological Research: A Review,
W79-05547 4C

Injection of Water Into Wells for Investigation of Limited Aquifer,
W79-05552 4B

Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

Water Resources Data for Wyoming, Water Year 1977--Volume 1. Missouri River Basin,
W79-05598 7C

Water Resources Data for Wyoming, Water Year 1977--Volume 2. Green River Basin, Bear River Basin, Snake River Basin,
W79-05599 7C

Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water,
W79-05643 5B

An Analysis of the Groundwater Resources of Tongatapu Island, Kingdom of Tonga,
W79-05827 2F

The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

Effect of Septic Tank Effluent on the Base Status of Two Tile-Drained Soils,
W79-05945 5B

Water Resources Data for Kansas, Water Year 1978,
W79-05989 7C

GROUNDWATER AVAILABILITY
Groundwater Projections for 11 Basins,
W79-05554 4B

Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire,
W79-05968 7C

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

GROUNDWATER BASINS
Groundwater Projections for 11 Basins,
W79-05554 4B

GROUNDWATER FLOW
Feasibility Study for Development of a Transient Three-Dimensional Groundwater Flow Model Utilizing the Finite Element Method,
W79-05799 2F

GROUNDWATER MOVEMENT
Tritium Dating of Some Groundwater Samples from Northwestern Iraqi Desert,
W79-05569 2F

GROUNDWATER POLLUTION
Groundwater Pollution. Part 2. Pollution from Irrigation and Fertilization. Vol. 2. 1977-January, 1978. (Citations from the NTIS Data Base),
W79-05826 5B

GROUNDWATER RECHARGE
Evaluation of Groundwater Flow and Recharge Through Glacial Drift, Michigan State Water Quality Management Project, East Lansing, Michigan,
W79-05791 4B

Disposal of a Large Quantity of Sodium Fluoroacetate in a Sanitary Landfill Site Located in an Aquifer Recharging Area,
W79-05835 5G

GROUNDWATER RESOURCES
Groundwater Projections for 11 Basins,
W79-05554 4B

Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

The Mississippi River Valley Alluvial Aquifer in Mississippi,
W79-05597 7C

Ground-Water Levels and Quality Data for Georgia, 1977,
W79-05607 4B

Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

Water Resources of South-Central Iowa,
W79-05609 7C

Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire,
W79-05968 7C

Ground-Water Data for 1976-77 in Joshua Tree National Monument, California,
W79-05982 2F

Water Resources of the Upper Duck River Basin, Central Tennessee,
W79-05985 6D

GULF OF ALASKA
Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

GULLS
Effects of Petroleum Exposure on the Breeding Ecology of the Gulf of Alaska Herring Gull Group and Reproductive Ecology of Large Gulls in the Northeast Gulf of Alaska,
W79-05923 5C

GUNNISON COUNTY
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

HABITAT DEGRADATION
Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

HABITATS
Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. I: Breeding Bird Use of Barrier Islands in the Northern Chukchi and Beaufort Seas,
W79-05676 5C

Shorebird Dependence on Arctic Littoral Habitats,
W79-05886 5C

Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

Plant Communities of Alaskan Arctic Beaches,
W79-05910 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Avian Ecology in Simpson Lagoon, 1977,
W79-05928 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Ecology of Fishes in Simpson Lagoon, 1977,
W79-05929 5C

HALL COEFFICIENTS
Research on Role of Ligand Molecules on Ionization Potentials,
W79-05864 3A

HALMSTAD (SWEDEN)
Local Infiltration of Storm Water,
W79-05550 4A

HALOPHILIC ORGANISMS
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

HALOTOLERANCE
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

HARVESTING OF ALGAE
Cultivating and Harvesting Algae to Forestall Accelerated Eutrophication,
W79-05584 5C

HAWAII
Long Wave Model Independent of Stability Criteria,
W79-05534 2L

HAZARD CLASSES
Earth Dams and Reservoirs,
W79-05612 2H

HAZARDS
Earth Dams and Reservoirs,
W79-05612 2H

The Care of Explosives,
W79-05998 8H

HEAT PUMPS
Research on Thermoelectric Heat Pumps,
W79-05875 3A

HEAT TRANSFER
Heat Transfer in the LTV Evaporator: An Analysis of Pilot Plant Data and Predictive Techniques for Plant Operation and Design,
W79-05581 3A

A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

Vapor Compression with Secondary Heat-Transfer Media.
W79-05873 3A

An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

HEAVY METALS
Spatial and Temporal Variation in Sedimentary Grain-Size Facies and Sediment Heavy Metal Ratios in the New York Bight Apex,
W79-05686 5C

Trace Metals in the New York Bight,
W79-05691 5B

Chromosome Mutagenesis in Developing Mackerel Eggs Sampled from the New York Bight,
W79-05703 5C

Chemistry of Phosphorus, Cadmium, Copper, Nickel, Lead, and Zinc in Indiana Lake and Reservoir Sediments,
W79-05794 5B

Detection of Heavy Metal Pollution in Estuarine Sediments,
W79-05850 5B

Trace Metal Transport from Mining, Milling, and Smelting Watersheds,
W79-05858 5B

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

Extractability of Cadmium, Copper, Nickel, and Zinc by Double Acid Versus DTPA and Plant Content at Excessive Soil Levels,
W79-05946 5B

Zinc and Cadmium Contents of Agricultural Soils and Corn in Northwestern Indiana,
W79-05947 5B

HEMIAULUS MEMBRANACEUS
An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

HERBICIDES
Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

Simazine Residue Levels in Irrigation Water After Ditchbank Application for Weed Control,
W79-05821 5B

HIGHWAY EFFECTS
Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

HOUSTON COUNTY (TX)
Nitrates and Bacterial Distribution in Rural Domestic Water Supplies,
W79-05524 5B

HUDSON RIVER
Estuarine Research: An Annotated Bibliography of Selected Literature, With Emphasis on the Hudson River Estuary, New York and New Jersey,
W79-05593 2L

Dye-Dispersion Study at Proposed Pumped-Storage Project on Hudson River at Cornwall-on-the-Hudson, New York,
W79-05596 5B

HUDSON RIVER BASIN
Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

HUMIDITY
Regional Mean Bowen Ratios Deduced from Diurnal Changes of Temperature and Humidity,
W79-05883 2A

HUNGARY
Hydrology and Water Control on Large Plains,
W79-05526 2A

HYDRATE PROCESSES
The Properties of Gas Hydrates and Their Use in Demineralizing Sea Water,
W79-05656 3A

HYDRATES
The Properties of Gas Hydrates and Their Use in Demineralizing Sea Water,
W79-05656 3A

HYDRATION
The Properties of Gas Hydrates and Their Use in Demineralizing Sea Water,
W79-05656 3A

HYDRAULIC MINING
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

HYDROCARBONS
The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

HYDROGEN
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

HYDROGEN ION CONCENTRATION
Acid Precipitation in the New York Metropolitan Area: Its Relationship to Meteorological Factors,
W79-05626 2K

HYDROGEOLOGY
The Mississippi River Valley Alluvial Aquifer in Mississippi,
W79-05597 7C

Geologic and Geophysical Data from Osceola National Forest, Florida,
W79-05605 5A

Physiography and Surficial Geology of the Copper-Nickel Study Region, Northeastern Minnesota,
W79-05984 7C

HYDROGRAPHS
The Effect of the Small-Slope Approximation and Lower Boundary Conditions on Solutions of the Saint-Venant Equations,
W79-05938 2E

HYDROGRAPHY
Distribution of Hydrographic Properties in the New York Bight Apex,
W79-05683 1A

HYDROLOGIC BUDGETS
Walker Branch Watershed: Site Description and Research Scope,
W79-05837 2A

HYDROLOGIC DATA
Twentieth-Century Semi-Arid Climates and Climatic Fluctuations in Texas and Northeastern Mexico,
W79-05563 2A

Proceedings of the First Membership Conference of the National Water Data Exchange, May 9-11, 1978, Denver, Colorado,
W79-05585 7C

Summary of the Water Resources of Puerto Rico,
W79-05592 6D

Hydrologic Data for Water-Table Aquifers in the Boulder--Fort Collins--Greeley Area, Front Range Urban Corridor, Colorado,
W79-05594 7C

Water Resources Data for Wyoming, Water Year 1977--Volume 1. Missouri River Basin,
W79-05598 7C

Water Resources Data for Wyoming, Water Year 1977--Volume 2. Green River Basin, Bear River Basin, Snake River Basin,
W79-05599 7C

Water Resources Data for Kansas, Water Year 1978,
W79-05989 7C

HYDROLOGIC MODEL
Hydrogeology and Computer Model of the Bass Lake Area, St. Croix County, Wisconsin,
W79-05795 2H

HYDROLOGIC MODELS
Feasibility Study for Development of a Transient Three-Dimensional Groundwater Flow Model Utilizing the Finite Element Method,
W79-05799 2F

HYDROLOGY
Hydrology and Water Control on Large Plains,
W79-05526 2A

Review Report on Umpqua River and Tributaries, Oregon, Interim Report, South Umpqua River, Volume III; (Appendix B--Hydrology, Meteorology, and Reservoir Regulation; Appendix C--Foundation and Materials Data; Appendix D--Recreation, Public Use, and Environment),
W79-05616 8A

The Effect of the Small-Slope Approximation and Lower Boundary Conditions on Solutions of the Saint-Venant Equations,
W79-05938 2E

HYDROLYSIS
Biological Hydrolysis of Parathion in Natural Ecosystems,
W79-05935 5B

Metabolism of Nitrophenols in Flooded Soils,
W79-05936 5A

ICE
Climatic Roles of Ice: A Contribution to the International Hydrological Programme (IHP),
W79-05527 2C

Lake Erie Ice: Winter 1975-76,
W79-05615 2C

Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

Melting of Ice in Sea Water: A Primitive Model with Application to the Antarctic Ice Shelf and Icebergs,
W79-05857 2C

River Ice,
W79-05860 2C

The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development on the Outer Continental Shelf of Alaska,
W79-05914 5C

Bering Sea Ice Edge Ecosystem Study: Nutrient Cycling and Organic Matter Transfer,
W79-05917 5C

ICE COVER
River Ice,
W79-05860 2C

ICE JAMS
Physical Measurement of Ice Jams, 1976-77 Field Season,
W79-05833 2C

River Ice,
W79-05860 2C

ICE-WATER INTERFACES
Research on Salt Water Purification by Freezing,
W79-05881 3A

ICELAND
Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

ILLINOIS
An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

Economic Impact of Proposed Amendments to Water Pollution Regulations, R77-12, Docket A.
W79-05753 6E

Assessment of Weather Modification in Alleviating Agricultural Water Shortages During Droughts,
W79-05836 2B

IMPINGEMENT
Fourth National Workshop on Entrainment and Impingement,
W79-05754 5C

Impingement Survival Studies on White Perch, Striped Bass, and Atlantic Tomcod at Three Hudson River Power Plants,
W79-05772 5C

Survival of Fishes and Macroinvertebrates Impinged at Oyster Creek Generating Station,
W79-05773 5C

An Analysis of Factors Influencing the Impingement of Threadfin Shad at Power Plants in the Southeastern United States,
W79-05774 5C

Comparative Fish Impingement at Two Adjacent Water Intakes on the Mid-Columbia River,
W79-05775 5C

Statistical Comparison and Choices of Sampling Designs for Estimating Fish Impingement at Cooling Water Intakes,
W79-05776 5C

Temporally Stratified Sampling Programs for Estimation of Fish Impingement,
W79-05777 5C

A Conceptual Model of Causal Factors Regarding Gizzard Shad Runs at Steam Electric Power Plants,
W79-05778 5C

Effect of Environmental Variables on Fish Impingement,
W79-05779 5C

Perspectives on Fish Impingement,
W79-05783 5C

Engineering Implications of New Fish Screening Concepts,
W79-05785 8I

Multifarious Power Plant Water Intake Structure: A Design to Reduce Impingement and Entrainment Mortality,
W79-05786 8I

A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish,
W79-05788 8I

Fisheries Issues Related to Water Development in the Sacramento-San Joaquin Estuary, California,
W79-05789 6G

Present Engineering Limitations to the Protection of Fish at Water Intakes,
W79-05790 8I

IMPOUNDMENTS
Evaluation of Planning for Fish and Wildlife, Lake Sharpe Reservoir Project,
W79-05717 6G

IMPURE PUBLIC GOODS
Congestion, Pollution, and Impure Public Goods,
W79-05748 6C

INDIA
Traditional Perceptabilities (Sic.) of Environment and Desertification: A Case Study,
W79-05562 6B

Computation of the Average Precipitation Over the Western Part of Peninsular India During the Summer Monsoon From the Continuity Equation for Atmospheric Water Vapour,
W79-05619 2B

A Statistical Study of the Annual Rainfall in the Sutlej Catchment and Annual Run-Off at Bhakra Dam Site,
W79-05628 2B

A Study of Large Floods in the Thambraparani River in Tamil Nadu,
W79-05629 2E

INDIAN RESERVATIONS
The Dark and Bloody Ground of Indian Water Rights: Confusion Elevated to Principle,
W79-05560 6E

INDUSTRIAL WASTES
Accomplishment Plan, Region VIII. Red River of the North Basin.
W79-05722 5G

Technology and Economics of Industrial Pollution Abatement,
W79-05865 5B

Removal of Color, Detergents, and Other Refractory Substances from Textile Wastewater,
W79-05867 5D

INDUSTRIAL WATER
Process for Protecting Asbestos-Cement Bearing Surfaces in Recirculating Cooling Water Systems,
W79-05949 8F

INDUTRIAL WASTES
Membrane Processes for Environmental Studies,
W79-05735 5D

INERTIA CURRENTS (WATER)
Inertial Currents in Lake Ontario, Winter 1972-73 (IFYGL),
W79-05634 2H

INFILTRATION
Local Infiltration of Storm Water,
W79-05550 4A

INFORMATION EXCHANGE
Proceedings of the First Membership Conference of the National Water Data Exchange, May 9-11, 1978, Denver, Colorado,
W79-05585 7C

INFRARED RADIATION
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

INJECTION WELLS
Injection of Water Into Wells for Investigation of Limited Aquifer,
W79-05552 4B

INSTITUTIONAL CONSTRAINTS
An Outline of Soil, Water and Agriculture in Arab Countries,
W79-05553 2A

Standard Setting and the Theory of Institutional Choice: The Case of Pollution Control,
W79-05749 6C

INSTRUMENTATION
Walker Branch Watershed: Site Description and Research Scope,
W79-05837 2A

An Automatic Sequential Rain Sampler,
W79-05847 7B

INTAKES
Engineering Implications of New Fish Screening Concepts,
W79-05785 8I

Multifarious Power Plant Water Intake Structure: A Design to Reduce Impingement and Entrainment Mortality,
W79-05786 8I

Preliminary Studies on the Operating Aspects of Small Slot Width Wedgewire Screens with Conceptual Designs for Power Station Use,
W79-05787 8I

A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish,
W79-05788 8I

Fisheries Issues Related to Water Development in the Sacramento-San Joaquin Estuary, California,
W79-05789 6G

INTAKES STRUCTURES
Effect of Environmental Variables on Fish Impingement,
W79-05779 5C

Perspectives on Fish Impingement,
W79-05783 5C

Multifarious Power Plant Water Intake Structure: A Design to Reduce Impingement and Entrainment Mortality,
W79-05786 8I

Preliminary Studies on the Operating Aspects of Small Slot Width Wedgewire Screens with Conceptual Designs for Power Station Use,
W79-05787 8I

A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish,
W79-05788 8I

INTERCEPTION
An Analytical Model of Rainfall Interception by Forests,
W79-05854 2D

INTERTIDAL AREAS
Patterns of Algal Succession in a Perturbated Marine Intertidal Community,
W79-05664 5C

Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

INVERTEBRATES
Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Overview and Synthesis,
W79-05927 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

ION EXCHANGE
Investigation and Development of an Electrolytic System for the Conversion of Saline and Brackish Waters,
W79-05579 3A

ION TRANSPORT
Part I: Survey of Physiological Mechanisms of Sodium and Chloride Ion Transport and Design of Experiment for Application to Demineralizing Saline Waters - Part II: Laboratory Evaluation of Use of Algae in Saline Water Conversion -- Phase I Final Report,
W79-05648 3A

IONIZATION
Research on Role of Ligand Molecules on Ionization Potentials,
W79-05864 3A

IONS
Research on Role of Ligand Molecules on Ionization Potentials,
W79-05864 3A

IOWA
Water Resources of South-Central Iowa,
W79-05609 7C

Surface Water Quality Associated with the Surface Mining of Iowa Coal,
W79-05834 5B

IRAQ
Tritium Dating of Some Groundwater Samples from Northwestern Iraqi Desert,
W79-05569 2F

Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

IRON
Evaluation of the Rate of Decrease in the Iron Content of Water Pumped from a Flooded Shaft Mine in County, Durham, England,
W79-05933 2K

IRON COUNTY (UTAH)
Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

IRRIGABLE LAND
Potential Use of Converted Sea Water for Irrigation in Parts of California and Texas,
W79-05645 3A

IRRIGATION
Effluent Irrigation of Coastal Bermuda Grass,
W79-05624 3C

Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water,
W79-05643 5B

Leaching of Cations and Chloride from Manure Applied to an Irrigated Soil,
W79-05931 5B

Sprinkler Nozzle,
W79-05952 3F

Casing Mounted Emitter,
W79-05953 3F

Drive Means for Irrigation System,
W79-05954 3F

Dual-Function Valve,
W79-05959 3F

Adjustable Bubbler Sprinkler Head,
W79-05960 3F

IRRIGATION DESIGN
Analysis of Trickle Irrigation with Application to Design Problems,
W79-05815 3F

Border-Strip Irrigation Design--Practical Approach from a Theoretical Basis,
W79-05992 3F

Rapidly Obtaining Optimal Irrigation System Designs,
W79-05993 3F

Computer Model for Center Pivot Sprinkler Design,
W79-05994 3F

Determining Center-Pivot Sprinkler Uniformities,
W79-05996 3F

IRRIGATION EFFECTS
Effects of Water Management and Soil Physical Properties on Cotton Production in the Rolling Plains,
W79-05557 3F

Grapefruit Response to Variable Salinity in Irrigation Water and Soil,
W79-05814 3C

The Effect of Supplemental Irrigation and Nitrogen Fertilization on Wheat (Triticum Aestivum L.),
W79-05817 2I

IRRIGATION EFFICIENCY
Corn Yields from Irrigation with Adequate and Deficient Water,
W79-05803 3F

Dual-Function Valve,
W79-05959 3F

Adjustable Bubbler Sprinkler Head,
W79-05960 3F

IRRIGATION PRACTICES
Biological Recovery Versus Desertization,
W79-05556 3B

IRRIGATION PROGRAMS
Determination of Optimal Well Capacities for Continuous Irrigation Programs,
W79-05825 3F

IRRIGATION SYSTEMS
Drive Means for Irrigation System,
W79-05954 3F

Dual-Function Valve,
W79-05959 3F

IRRIGATION WATER
Land and Water Use in Saudi Arabia,
W79-05561 5G

Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

Simazine Residue Levels in Irrigation Water After Ditchbank Application for Weed Control,
W79-05821 5B

ITALY
Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

JAMES RIVER (VA)
Quantitative Analysis of Aircraft Multispectral-Scanner Data and Mapping of Water-Quality Parameters in the James River in Virginia,
W79-05862 7B

JAMES RIVER (VIRGINIA)
Water Quality Improvements from Upgraded Waste Treatment,
W79-05503 5D

JAPAN
Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

JOSHUA TREE NATIONAL MONUMENT
Ground-Water Data for 1976-77 in Joshua Tree National Monument, California,
W79-05982 2F

KAMLOOPS (BRITISH COLUMBIA)
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

KANEOHE BAY (HI)
Long Wave Model Independent of Stability Criteria,
W79-05534 2L

KANSAS
Water Resources Data for Kansas, Water Year 1978,
W79-05989 7C

KINETICS
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

LAGOONS
Solids Control in Effluents from Aerated Lagoon Systems,
W79-05828 5D

LAKE BURLEY GRIFFIN (AUSTRALIA)
A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

LAKE ERIE
Lake Erie Ice: Winter 1975-76,
W79-05615 2C

LAKE LIVINGSTON (TX)
A Review of Phytoplankton Studies in Lake Livingston, Texas,
W79-05806 5C

LAKE MORPHOLOGY
Major Chemical Constituents of Arizona Lakes,
W79-05567 2H

LAKE OKEECHOBEE (FL)
Application of Ridge Regression Analysis to Water Resources Studies,
W79-05853 2A

LAKE ONTARIO
Analysis of Cool Season Lake-Related Mesoscale Phenomena Using Numerical Variational Analysis,
W79-05523 2B

Inertial Currents in Lake Ontario, Winter 1972-73 (IFYGL),
W79-05634 2H

A Three-Dimensional Model of Lake Ontario's Summer Circulation, II. A Diagnostic Study,
W79-05635 2H

LAKE RESTORATION
Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

LAKE SALLY
Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6D

LAKE SEDIMENTS
Chemistry of Phosphorus, Cadmium, Copper, Nickel, Lead, and Zinc in Indiana Lake and Reservoir Sediments,
W79-05794 5B

LAKE SHARPE RESERVOIR (SD)
Evaluation of Planning for Fish and Wildlife, Lake Sharpe Reservoir Project,
W79-05717 6G

LAKE WILLIAM (NOVA SCOTIA)
Migrating Thermal Structure in a Freshwater Thermocline,
W79-05636 2H

LAKES
Analysis of Cool Season Lake-Related Mesoscale Phenomena Using Numerical Variational Analysis,
W79-05523 2B

Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

Major Chemical Constituents of Arizona Lakes,
W79-05567 2H

Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

Migrating Thermal Structure in a Freshwater Thermocline,
W79-05636 2H

A Compendium of Lake and Reservoir Data Collected by the National Eutrophication Survey in the Central United States.
W79-05732 5C

A Compendium of Lake and Reservoir Data Compiled by the National Eutrophication Survey in the Western United States.
W79-05733 5C

Hydrogeology and Computer Model of the Bass Lake Area, St. Croix County, Wisconsin,
W79-05795 2H

Application of Ridge Regression Analysis to Water Resources Studies,
W79-05853 2A

Assessment of a Cooling Lake Ecosystem,
W79-05964 2H

Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6D

LALES
Mathematical Model and Computer Simulation of the Population Dynamics of Zooplankton in Lake and Estuary Ecosystems,
W79-05739 5C

LAND FORMS
Arid Geomorphology,
W79-05558 2J

LAND MANAGEMENT
Traditional Perceptabilities (Sic.) of Environment and Desertification: A Case Study,
W79-05562 6B

LAND USE
Growth Effects of Major Land Use Projects (Wastewater Facilities), Volume I: Model Specification and Causal Analysis,
W79-05866 6G

Effects of Land Use and Water Management on Water Quality in the Western South New River Canal Basin, Southeast Florida, 1974-75,
W79-05978 4C

LAND USE PLANNING
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

LANDFILLS
Tough Environmental Requirements Demand New Approaches to Landfill,
W79-05505 5E

Disposal of a Large Quantity of Sodium Fluoroacetate in a Sanitary Landfill Site Located in an Aquifer Recharging Area,
W79-05835 5G

Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

LANDSAT IMAGES
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

LEACHING
Nitrogen Inputs and Losses in Tobacco, Bean, and Potato Fields in a Sandy Loam Watershed,
W79-05819 5B

Leaching of Cations and Chloride from Manure Applied to an Irrigated Soil,
W79-05931 5B

Influence of the Chemical Form of Mercury on Its Adsorption and Ability to Leach Through Soils,
W79-05944 5B

Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

LEAD
Health Hazards from Drinking-Water.
W79-05726 5A

LEAKAGE
Possible Mechanisms for Leakage Between Aquifers and Rivers,
W79-05851 2F

LEGAL ASPECTS
The Dark and Bloody Ground of Indian Water Rights: Confusion Elevated to Principle,
W79-05560 6E

LEGISLATION
Economic Impact of Proposed Amendments to Water Pollution Regulations, R77-12, Docket A.
W79-05753 6E

The Role of the Scientist in the Section 316 Process: A Lawyer's Point of View,
W79-05758 5C

LETHAL LIMIT
Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

LIFE HISTORY STUDIES
Biology of the Harbor Seal, Phoca Vitulina Richardi, in the Gulf of Alaska,
W79-05669 5C

The Natural History and Ecology of the Bearded Seal (Erignathus Barbatus) and the Ringed Seal (Phoca Hispida),
W79-05670 5C

Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

LIMITING FACTORS
A Review of Phytoplankton Studies in Lake Livingston, Texas,
W79-05806 5C

LIMNOLOGY
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

LIQUID-LIQUID EXTRACTION
Development of the Solvent Demineralization of Saline Water,
W79-05650 3A

Research on Liquid-Liquid Extraction for Saline Water Conversion,
W79-05654 3A

LIQUID-LIQUID HEAT EXCHANGE
Research on Vapor Reheat and Liquid-Liquid Heat Exchange,
W79-05574 3A

LITHOLOGIC LOGS
Geologic and Geophysical Data from Osceola National Forest, Florida,
W79-05605 5A

LITTLE LEHIGH CREEK (PA)
Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

LITTORAL
Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

LITTORAL DRIFT
Developmental Tests on the Use of Fluorescent Tracers and Backwash Sediment-Load Samplers to Measure the Beach Drift Component of Littoral Transport at Sandy Hook, New Jersey,
W79-05688 2J

Longshore Transport at a Total Littoral Barrier,
W79-05838 2H

LOADS (FORCES)
Wave Forces on Cylinders Near Plane Boundaries,
W79-05532 2L

LONDON BASIN
The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

LONG ISLAND
Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

LONG-TUBE VERTICAL DISTILLATION
Annual Report (FY 1969) Freeport Test Facility and Vertical-Tube-Evaporator Test Bed Plant, Freeport, Texas,
W79-05652 3A

LONG TUBE VERTICAL EVAPORATOR
Heat Transfer in the LTV Evaporator: An Analysis of Pilot Plant Data and Predictive Techniques for Plant Operation and Design,
W79-05581 3A

LONG-TUBE VERTICAL MULTIPLE EFFECT EVAPORATION
First Annual Report: Saline Water Conversion Plant No 1, Freeport, Texas.
W79-05662 3A

LOW FLOW
Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

Selected Low-Flow Characteristics of Streams in the Vicinity of Warwick, Orange County, New York,
W79-05595 2E

LOWER HILLSBOROUGH RIVER (FL)
Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

LUMBRICULUS VARIEGATUS
Importance of Algae in the Diet of the Oligochaetes Lumbriculus Variegatus (Muller) and Rhyacodrulus Sodalis (Eisen),
W79-05517 5C

MACHETE
Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

MAINE
Quality of Selected Waters in Southern Maine.
W79-05832 5B

MAJOR COST CENTER ANALYSIS
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

MAMMALS
Baseline Characterization of Marine Mammals in the Bering Sea: Distribution and Abundance,
W79-05665 5C

Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska,
W79-05666 5C

Seasonal Distribution and Abundance of Bowhead and Beluga Whales in the Bering Sea and Arctic Ocean,
W79-05667 5C

Morbidity and Mortality of Marine Mammals,
W79-05668 5C

Biology of the Harbor Seal, Phoca Vitulina Richardi, in the Gulf of Alaska,
W79-05669 5C

Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

An Amendment to RU232 Trophic Relationships Among Ice Inhabiting Phocid Seals, and RU230 Natural History of Ringed and Bearded Seals,
W79-05672 5C

Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity - Their Numbers and Seasonal Movements,
W79-05674 5C

Effects of Oiling on Temperature Regulation in Sea Otters,
W79-05921 5C

MANUALS
Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

MAPPING
Eastern-Western Arctic Sea Ice Analyses,
W79-05613 2C

Flight Path Curvature Distortion in Side-Looking Airborne Radar Imagery,
W79-05973 7B

MAPS
Map Showing Drainage Areas, Columbia Quadrangle, Connecticut,
W79-05600 7C

Map Showing Drainage Areas, Norfolk Quadrangle, Connecticut,
W79-05601 7C

Map Showing Drainage Areas, New Britain Quadrangle, Connecticut,
W79-05602 7C

Map Showing Drainage Areas, Collinsville Quadrangle, Connecticut,
W79-05603 7C

Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

MARINE ALGAE
Part I: Survey of Physiological Mechanisms of Sodium and Chloride Ion Transport and Design of Experiment for Application to Demineralizing Saline Waters - Part II: Laboratory Evaluation of Use of Algae in Saline Water Conversion -- Phase I Final Report,
W79-05648 3A

An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

MARINE MICROORGANISMS
Geologic and Geophysical Data from Osceola National Forest, Florida,
W79-05605 5A

MARQUETTE COUNTY (MICH)
Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6D

MATHEMATICAL MODELS
Simplified Muskingum Routing Equation,
W79-05536 2E

Flow Profiles in Trapezoidal Channels by Pocket Calculators,
W79-05538 8B

Some Results from Urban Runoff Studies in Bergsjon Goteborg,
W79-05548 2A

Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

The Effect of the Small-Slope Approximation and Lower Boundary Conditions on Solutions of the Saint-Venant Equations,
W79-05938 2E

Mathematical Models and Border Irrigation Design,
W79-05991 3F

MAXWELL CREEK (TX)
Flood Plain Information: Maxwell Creek, Parker, Texas,
W79-05719 2E

MEASUREMENT
Physical Measurement of Ice Jams, 1976-77 Field Season,
W79-05833 2C

MELT WATER
Application of LANDSAT Imagery for Snow Mapping in Norway,
W79-05617 7B

MELTING
Melting of Ice in Sea Water: A Primitive Model with Application to the Antarctic Ice Shelf and Icebergs,
W79-05857 2C

MEMBRANE PROCESSES
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

Investigation and Development of an Electrolytic System for the Conversion of Saline and Brackish Waters,
W79-05579 3A

Membrane Processes for Environmental Studies,
W79-05735 5D

MEMBRANES
Theoretical Studies of the Behavior of Ions in Aqueous Solutions of Mixed Electrolytes with Respect to Osmionic Operation,
W79-05647 3A

The Mechanism of Desalination by Reverse Osmosis,
W79-05878 3A

Study of Oriented Cellulose Membranes for Reverse Osmosis and the Relationship Between Morphology and Salt Rejection,
W79-05879 3A

MERCURY
Antimicrobial Resistant Bacteria in the New York Bight,
W79-05708 5C

The Uptake of 203Hg-Labeled Mercury Compounds by Bromegrass from Irrigated Undisturbed Soil Columns,
W79-05943 5B

Influence of the Chemical Form of Mercury on Its Adsorption and Ability to Leach Through Soils,
W79-05944 5B

MERRIMACK RIVER BASIN (NH)
Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire,
W79-05968 7C

METABOLISM
Effects of Oiling on Temperature Regulation in Sea Otters,
W79-05921 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

METALS
Suspended Particulate Concentrations and Compositions in the New York Bight,
W79-05687 5C

Corrosion of Metals in Sea Water,
W79-05870 3A

Concentrations of Metals in Very Small Volumes of Soil Solution,
W79-05976 7B

METHANE
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

METHODOLOGY
Economics of Water Development in Less Developed Countries,
W79-05750 6B

National Water Data Coordination in the United States,
W79-05971 7A

MEXICO
Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

MICHAELIS-MENTEN EQUATIONS
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

MICROBIAL DEGRADATION
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development on the Outer Continental Shelf of Alaska,
W79-05914 5C

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

MICROCYSTIS AERUGINOSA
Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

MICROORGANISMS
Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development on the Outer Continental Shelf of Alaska,
W79-05914 5C

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

MICROWAVES
Estimation of Snow Temperature and Mean Crystal Radius From Remote Multispectral Passive Microwave Measurements,
W79-05518 2C

Dielectric Constants of Soils at Microwave Frequencies--II,
W79-05861 2G

MIGRATIONS
Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

MIGRATORY BIRDS
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska,
W79-05675 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. I: Breeding Bird Use of Barrier Islands in the Northern Chukchi and Beaufort Seas,
W79-05676 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. II: Feeding Habits of Birds in the Beaufort Sea,
W79-05677 5C

MINE ACIDS
Surface Water Quality Associated with the Surface Mining of Iowa Coal,
W79-05834 5B

MINE WASTES
Surface Water Quality Associated with the Surface Mining of Iowa Coal,
W79-05834 5B

MINE WATER
Evaluation of the Rate of Decrease in the Iron Content of Water Pumped from a Flooded Shaft Mine in County, Durham, England,
W79-05933 2K

MINERALOGY
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

MINING
Surface Water Quality Associated with the Surface Mining of Iowa Coal,
W79-05834 5B

Trace Metal Transport from Mining, Milling, and Smelting Watersheds,
W79-05858 5B

MINNESOTA
Physiography and Surficial Geology of the Copper-Nickel Study Region, Northeastern Minnesota,
W79-05984 7C

MISSISSIPPI
Proceedings for Gathering Ground Truth Information for a Supervised Approach to a Computer-Implemented Land Cover Classification of Landsat-Acquired Multispectral Scanner Data,
W79-05859 7B

MISSISSIPPI RIVER VALLEY ALLUVIAL AQUIFER
The Mississippi River Valley Alluvial Aquifer in Mississippi,
W79-05597 7C

MISSOURI
Trace Metal Transport from Mining, Milling, and Smelting Watersheds,
W79-05858 5B

MISSOURI RIVER BASIN
Water Resources Data for Wyoming, Water Year 1977--Volume 1. Missouri River Basin,
W79-05598 7C

MIXING
Dye-Dispersion Study at Proposed Pumped-Storage Project on Hudson River at Cornwall-on-the-Hudson, New York,
W79-05596 5B

MODEL STUDIES
Entrainment Impact Estimates Using the Equivalent Adult Approach,
W79-05516 5C

Estimation of Snow Temperature and Mean Crystal Radius From Remote Multispectral Passive Microwave Measurements,
W79-05518 2C

Analysis of Cool Season Lake-Related Mesoscale Phenomena Using Numerical Variational Analysis,
W79-05523 2B

Climatic Roles of Ice: A Contribution to the International Hydrological Programme (IHP),
W79-05527 2C

Predicting Sand Deposition at Porous Fences,
W79-05533 2J

Long Wave Model Independent of Stability Criteria,
W79-05534 2L

Waves in Front of Long-Based Weirs,
W79-05540 8B

Subsidence of Peak Flow in Channels with Storage Areas,
W79-05541 2E

Effects of Hindered Settling on Sediment Concentration Profiles,
W79-05542 2J

Some Results from Urban Runoff Studies in Bergsjon Goteborg,
W79-05548 2A

Some Aspects on Urban Runoff Quality Modeling,
W79-05549 5B

Computation of the Average Precipitation Over the Western Part of Peninsular India During the Summer Monsoon From the Continuity Equation for Atmospheric Water Vapour,
W79-05619 2B

A Note on the Internal Solitary Waves Produced by Tidal Flow Over a Three-Dimensional Ridge,
W79-05631 2L

A Large-Scale Numerical Model of Sea Ice,
W79-05632 2C

Comparison of 2.8- and 21-Cm Microwave Radiometer Observations over Soils with Emission Model Calculations,
W79-05633 7B

A Three-Dimensional Model of Lake Ontario's Summer Circulation, II. A Diagnostic Study,
W79-05635 2H

Migrating Thermal Structure in a Freshwater Thermocline,
W79-05636 2H

The Modeling of Tidal Flow in a Channel Using a Turbulence Energy Closure Scheme,
W79-05637 2L

Models Useful for the Estimation of Equilibrium Population Reduction Due to Power Plant Cropping,
W79-05764 5C

A Method for Determining Growth and Mortality Rates of Ichthyoplankton,
W79-05765 5C

A Conceptual Model of Causal Factors Regarding Gizzard Shad Runs at Steam Electric Power Plants,
W79-05778 5C

A Mathematical Model of the Interactions of an Aquatic Ecosystem and a Thermal Power Station Cooling System,
W79-05781 5C

A Print-Plot Display System for a Linear Programming-Based Resources Planning Model,
W79-05797 6A

Subsurface Drainage Model with Associated Sediment Transport,
W79-05802 2J

Determination of Optimal Well Capacities for Continuous Irrigation Programs,
W79-05825 3F

Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

Possible Mechanisms for Leakage Between Aquifers and Rivers,
W79-05851 2F

An Analytical Model of Rainfall Interception by Forests,
W79-05854 2D

Dew and Thermal Lag: A Model for Cocoa Pods,
W79-05856 2B

Melting of Ice in Sea Water: A Primitive Model with Application to the Antarctic Ice Shelf and Icebergs,
W79-05857 2C

The Effect of the Small-Slope Approximation and Lower Boundary Conditions on Solutions of the Saint-Venant Equations,
W79-05938 2E

Modeling Nitrogen, Oxygen, Chattahoochee River, GA.,
W79-05974 5B

MODELS
A Conceptual Representation of the New York Bight Ecosystem,
W79-05696 5B

Benthic Colonization Processes--A Review and a Proposed New Model,
W79-05707 5C

Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

MOISTURE CONTENT
Concentration and Size of Gravel in Relation to Neutron Moisture and Density Probe Calibration,
W79-05530 7B

*MONITORING
Temporally Stratified Sampling Programs for Estimation of Fish Impingement,
W79-05777 5C

Monitoring Areawide Rural Water Quality,
W79-05842 5A

MONROE COUNTY
Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

MONSOONS
Computation of the Average Precipitation Over the Western Part of Peninsular India During the Summer Monsoon From the Continuity Equation for Atmospheric Water Vapour,
W79-05619 2B

MONTANA
Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

MORTALITY
Survey of Beached Marine Birds in Alaska,
W79-05903 5C

MOUNTAIN STREAMS
The Suspended Sediment Regime of an Oregon Coast Range Stream,
W79-05846 2J

MT. BOLD RESERVOIR (AUSTRALIA)
Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

MULTIPLE-EFFECT EVAPORATION
Research Investigations of Multiple-Effect Evaporation of Saline Waters by Steam from Solar Radiation,
W79-05573 3A

MUNICIPAL WASTES
Removal of Color, Detergents, and Other Refractory Substances from Textile Wastewater,
W79-05867 5D

MUNICIPAL WATER
Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

MUSKINGUM METHOD
Translatory Characteristics of the Muskingum Method of Flood Routing,
W79-05941 2E

MUTAGENESIS
Chromosome Mutagenesis in Developing Mackerel Eggs Sampled from the New York Bight,
W79-05703 5C

MUTATION
Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

NASSAU COUNTY
Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

NATIONAL EUTROPHICATION SURVEY
A Compendium of Lake and Reservoir Data Collected by the National Eutrophication Survey in the Central United States.
W79-05732 5C

A Compendium of Lake and Reservoir Data Compiled by the National Eutrophication Survey in the Western United States.
W79-05733 5C

NATIONAL WATER DATA EXCHANGE (NAWDEX)
Proceedings of the First Membership Conference of the National Water Data Exchange, May 9-11, 1978, Denver, Colorado,
W79-05585 7C

NATURAL STREAMS
Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

NEARSHORE ZONES
Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

NETWORK ANALYSIS
Synthesis and Calibration of a River Basin Water Management Model,
W79-05583 6B

NETWORK DESIGN
National Water Data Coordination in the United States,
W79-05971 7A

NEW BRITAIN QUADRANGLE
Map Showing Drainage Areas, New Britain Quadrangle, Connecticut,
W79-05602 7C

NEW ENGLAND
Selected Priorities: 1978-82--A First-Year Effort Recommending Priorities for Selected Federal Water and Related Land Resource Programs in New England.
W79-05724 6E

NEW HAMPSHIRE
Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire,
W79-05968 7C

NEW MEXICO
Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

NEW YORK
Selected Low-Flow Characteristics of Streams in the Vicinity of Warwick, Orange County, New York,
W79-05595 2E

Acid Precipitation in the New York Metropolitan Area: Its Relationship to Meteorological Factors,
W79-05626 2K

V YORK BIGHT
an's Impact on the Middle Atlantic Continen- Shelf and the New York Bight--Symposium ımmary,
79-05679 5B

ıysical Oceanography of the Middle Atlantic ght,
79-05680 2J

cean-Atmosphere Interactions Off the North- st Coast of North America,
79-05681 5B

ew York Bight Water Stratification--October 74,
79-05682 1A

istribution of Hydrographic Properties in the ew York Bight Apex,
79-05683 1A

lorphologic Evolution and Coastal Sand Trans- ort, New York--New Jersey Shelf,
79-05684 2J

urficial Sediments of the NOAA-MESA Study reas in the New York Bight,
79-05685 5B

patial and Temporal Variation in Sedimentary rain-Size Facies and Sediment Heavy Metal atios in the New York Bight Apex,
79-05686 5C

uspended Particulate Concentrations and Com- ositions in the New York Bight,
79-05687 5C

Developmental Tests on the Use of Fluorescent Tracers and Backwash Sediment-Load Samplers o Measure the Beach Drift Component of Litto- al Transport at Sandy Hook, New Jersey,
W79-05688 2J

Sources of Urban Wastes,
W79-05689 5B

Contaminants Entering the New York Bight: Sources, Mass Loads, Significance,
W79-05690 5B

Trace Metals in the New York Bight,
W79-05691 5B

Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

Raritan Bay as a Source of Ammonium and Chlorophyll A for the New York Bight Apex,
W79-05693 5B

Oxygen Depletion in the New York Bight Apex: Causes and Consequences,
W79-05694 5B

Carbohydrates and Organic Carbon in New York Bight Sediments as Possible Indicators of Sewage Contamination,
W79-05695 5B

A Conceptual Representation of the New York Bight Ecosystem,
W79-05696 5B

Phytoplankton Productivity in the Apex of the New York Bight: Environmental Regulation of Productivity/Chlorophyll A,
W79-05697 5B

Middle Atlantic Fisheries: Recent Changes in Populations and Outlook,
W79-05700 5C

Some Results of Fish Surveys in the Mid-Atlantic Important For Assessing Environmental Impacts,
W79-05701 5C

Fin Rot Disease Studies in the New York Bight,
W79-05702 5C

Chromosome Mutagenesis in Developing Mackerel Eggs Sampled from the New York Bight,
W79-05703 5C

Bacterial Flux in Some New Jersey Estuarine Sediments,
W79-05704 2L

Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

Benthic-Pelagic Coupling in the New York Bight,
W79-05706 5C

Benthic Colonization Processes--A Review and a Proposed New Model,
W79-05707 5C

Antimicrobial Resistant Bacteria in the New York Bight,
W79-05708 5C

Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

Safe Shellfish from the Sea,
W79-05713 5C

NITRATE
Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water,
W79-05643 5B

NITRATES
Nitrates and Bacterial Distribution in Rural Domestic Water Supplies,
W79-05524 5B

Health Hazards from Drinking-Water.
W79-05726 5A

NITRIFICATION
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

Effects of SO2 and NO2 on Nitrification in Soil,
W79-05940 5B

NITROGEN
Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: I. Nitrate-Nitrogen and Chloride Distribution in Soil Profiles,
W79-05641 5B

Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: II. Nitrogen and Chloride Transport in Runoff,
W79-05642 5B

Ammonia Volatilization Losses from Flooded Rice Soils,
W79-05812 2K

Timing and Rate of Fertilizer Nitrogen for Sugarbeets Related to Nitrogen Uptake and Pollution Potential,
W79-05939 5B

Modeling Nitrogen, Oxygen, Chattahoochee River, GA.,
W79-05974 5B

NITROGEN FIXATION
Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

NITROGEN REMOVAL
Nitrogen Inputs and Losses in Tobacco, Bean, and Potato Fields in a Sandy Loam Watershed,
W79-05819 5B

NONPOINT POLLUTION
Nonpoint Source Pollution,
W79-05582 5B

Influence of Non-Point Pollution Sources in Connection with the Tuy River Basin Sanitation Studies,
W79-05740 5A

NORFOLK QUADRANGLE
Map Showing Drainage Areas, Norfolk Quadrangle, Connecticut,
W79-05601 7C

NORTH CAROLINA
Distribution of Suspended Bacteria in the Newport River Estuary, North Carolina,
W79-05623 2L

NORTHERN HEMISPHERE
Eastern-Western Arctic Sea Ice Analyses,
W79-05613 2C

NORWAY
Application of LANDSAT Imagery for Snow Mapping in Norway,
W79-05617 7B

NOSTOC MUSCORUM
Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

NOVA SCOTIA
Seasonal Changes in Oxygen Uptake by Settled Particulate Matter and Sediments in a Marine Bay,
W79-05638 2L

Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

NUCLEAR METERS
Concentration and Size of Gravel in Relation to Neutron Moisture and Density Probe Calibration,
W79-05530 7B

NUMERICAL ANALYSIS
The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

NUTRIENT BUDGETS
A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

NUTRIENT REMOVAL
Nitrogen and Phosphorus Losses from Organic Soils,
W79-05823 5B

NUTRIENTS
Walker Branch Watershed: Site Description and Research Scope,
W79-05837 2A

Wet and Dry Deposition of Nutrients in Central Alberta,
W79-05849 5B

Report on Zooplankton Community Grazing Experiments Conducted on Board the NOAA Ship, Discoverer, in the Bering Sea, May-June 1977,
W79-05918 5C

Nutrient Dynamics in Nearshore Under-Ice Waters,
W79-05920 5C

OBSERVATION WELLS
Ground-Water Levels and Quality Data for Georgia, 1977,
W79-05607 4B

OCEAN CIRCULATION
Physical Oceanography of the Middle Atlantic Bight,
W79-05680 2J

OCEAN DUMPING
Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5B

Surficial Sediments of the NOAA-MESA Study Areas in the New York Bight,
W79-05685 5B

Suspended Particulate Concentrations and Compositions in the New York Bight,
W79-05687 5C

Sources of Urban Wastes,
W79-05689 5B

Contaminants Entering the New York Bight: Sources, Mass Loads, Significance,
W79-05690 5B

Trace Metals in the New York Bight,
W79-05691 5B

Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

OCEANOGRAPHY
Physical Oceanography of the Middle Atlantic Bight,
W79-05680 2J

Distribution of Hydrographic Properties in the New York Bight Apex,
W79-05683 1A

OFFICE OF WATER DATA COORDINATION (OWDC)
National Water Data Coordination in the United States,
W79-05971 7A

OIL
Sources and Fates of Aromatic Compounds in Urban Stormwater Runoff,
W79-05627 5A

OIL POLLUTION
Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

Dynamics of Marine Bird Populations on the Barren Islands, Alaska,
W79-05899 5C

Community Structure of Seabirds of Wooded Island, Alaska,
W79-05900 5C

Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development on the Outer Continental Shelf of Alaska,
W79-05914 5C

Effects of Oiling on Temperature Regulation in Sea Otters,
W79-05921 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

Effects of Petroleum Exposure on the Breeding Ecology of the Gulf of Alaska Herring Gull Group and Reproductive Ecology of Large Gulls in the Northeast Gulf of Alaska,
W79-05923 5C

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

Composition and Source Identification of Organic Detritus in Lower Cook Inlet,
W79-05925 5C

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

Apparatus for Removing Rainbows from Flowing Water,
W79-05961 5G

OIL SPILLS
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska,
W79-05675 5C

Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

Shorebird Dependence on Arctic Littoral Habitats,
W79-05886 5C

Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

OKEFENOKEE SWAMP (GA)
Community Structure, Dynamics and Nutrients Cycling in the Okefenokee Cypress Swamp-Forest,
W79-05746 5C

OKHA (INDIA)
Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

OKLAHOMA
Selected Water-Level Records for Oklahoma, 1975-1977,
W79-05604 2F

OLIGOCHAETES
Importance of Algae in the Diet of the Oligochaetes Lumbriculus Variegatus (Muller) and Rhyacodrulus Sodalis (Eisen),
W79-05517 5C

OLIGOTROPHY
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

ON-SITE DATA COLLECTION
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

ON-SITE DATA INVESTIGATIONS
Distribution of Suspended Bacteria in the Newport River Estuary, North Carolina,
W79-05623 2L

ON-SITE INVESTIGATIONS
Migrating Thermal Structure in a Freshwater Thermocline,
W79-05636 2H

Seasonal Changes in Oxygen Uptake by Settled Particulate Matter and Sediments in a Marine Bay,
W79-05638 2L

Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

ONTARIO
Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

OPEN CHANNEL FLOW
Supercritical Flow in Bends of Trapezoidal Section,
W79-05531 2E

Mean Air Concentration of Self-Aerated Flow,
W79-05537 8B

Flow Profiles in Trapezoidal Channels by Pocket Calculators,
W79-05538 8B

A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

OPTIMUM DEVELOPMENT PLANS
An Outline of Soil, Water and Agriculture in Arab Countries,
W79-05553 2A

ORANGE COUNTY (NY)
Selected Low-Flow Characteristics of Streams in the Vicinity of Warwick, Orange County, New York,
W79-05595 2E

OREGON
Review Report on Umpqua River and Tributaries, Oregon, Interim Report, South Umpqua River, Volume III; (Appendix B--Hydrology, Meteorology, and Reservoir Regulation; Appendix C--Foundation and Materials Data; Appendix D--Recreation, Public Use, and Environment),
W79-05616 8A

The Suspended Sediment Regime of an Oregon Coast Range Stream,
W79-05846 2J

ORGANIC COMPOUNDS
Carbohydrates and Organic Carbon in New York Bight Sediments as Possible Indicators of Sewage Contamination,
W79-05695 5B

ORGANIC MATTER
Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

ORGANIZATIONS
The Founding of the Salt River Water Users Association,
W79-05555 6E

ORGANOPHOSPHORUS COMPOUNDS
Biological Hydrolysis of Parathion in Natural Ecosystems,
W79-05935 5B

OROGRAPHY
Persistence and Orographic Modulation of Mesoscale Precipitation Areas in a Potentially Unstable Warm Sector,
W79-05855 2B

OSCEOLA NATIONAL FOREST (FL)
Geologic and Geophysical Data from Osceola National Forest, Florida,
W79-05605 5A

OSMIONIC PROCESS
Theoretical Studies of the Behavior of Ions in Aqueous Solutions of Mixed Electrolytes with Respect to Osmionic Operation,
W79-05647 3A

OTTAUQUECHEE RIVER (VT)
Physical Measurement of Ice Jams, 1976-77 Field Season,
W79-05833 2C

OTTERS
Effects of Oiling on Temperature Regulation in Sea Otters,
W79-05921 5C

OUTER CONTINENTAL SHELF
Baseline Characterization of Marine Mammals in the Bering Sea: Distribution and Abundance,
W79-05665 5C

Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska,
W79-05666 5C

Seasonal Distribution and Abundance of Bowhead and Beluga Whales in the Bering Sea and Arctic Ocean,
W79-05667 5C

Morbidity and Mortality of Marine Mammals,
W79-05668 5C

Biology of the Harbor Seal, Phoca Vitulina Richardi, in the Gulf of Alaska,
W79-05669 5C

The Natural History and Ecology of the Bearded Seal (Erignathus Barbatus) and the Ringed Seal (Phoca Hispida),
W79-05670 5C

Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

An Amendment to RU232 Trophic Relationships Among Ice Inhabiting Phocid Seals, and RU230 Natural History of Ringed and Bearded Seals,
W79-05672 5C

Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity - Their Numbers and Seasonal Movements,
W79-05674 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska,
W79-05675 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. I: Breeding Bird Use of Barrier Islands in the Northern Chukchi and Beaufort Seas,
W79-05676 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. II: Feeding Habits of Birds in the Beaufort Sea,
W79-05677 5C

Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5C

Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5B

Physical Oceanography of the Middle Atlantic Bight,
W79-05680 2J

Ocean-Atmosphere Interactions Off the Northeast Coast of North America,
W79-05681 5B

New York Bight Water Stratification--October 1974,
W79-05682 1A

Distribution of Hydrographic Properties in the New York Bight Apex,
W79-05683 1A

Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

Surficial Sediments of the NOAA-MESA Study Areas in the New York Bight,
W79-05685 5B

Spatial and Temporal Variation in Sedimentary Grain-Size Facies and Sediment Heavy Metal Ratios in the New York Bight Apex,
W79-05686 5C

Suspended Particulate Concentrations and Compositions in the New York Bight,
W79-05687 5C

Developmental Tests on the Use of Fluorescent Tracers and Backwash Sediment-Load Samplers to Measure the Beach Drift Component of Littoral Transport at Sandy Hook, New Jersey,
W79-05688 2J

Sources of Urban Wastes,
W79-05689 5B

Contaminants Entering the New York Bight: Sources, Mass Loads, Significance,
W79-05690 5B

Trace Metals in the New York Bight,
W79-05691 5B

Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

Raritan Bay as a Source of Ammonium and Chlorophyll A for the New York Bight Apex,
W79-05693 5B

Oxygen Depletion in the New York Bight Apex: Causes and Consequences,
W79-05694 5B

Carbohydrates and Organic Carbon in New York Bight Sediments as Possible Indicators of Sewage Contamination,
W79-05695 5B

A Conceptual Representation of the New York Bight Ecosystem,
W79-05696 5B

Phytoplankton Productivity in the Apex of the New York Bight: Environmental Regulation of Productivity/Chlorophyll A,
W79-05697 5B

Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

Effects of Coastal Pollution on Fish and Fisheries--With Particular Reference to the Middle Atlantic Bight,
W79-05699 5C

Middle Atlantic Fisheries: Recent Changes in Populations and Outlook,
W79-05700 5C

Some Results of Fish Surveys in the Mid-Atlantic Important For Assessing Environmental Impacts,
W79-05701 5C

Fin Rot Disease Studies in the New York Bight,
W79-05702 5C

Chromosome Mutagenesis in Developing Mackerel Eggs Sampled from the New York Bight,
W79-05703 5C

Bacterial Flux in Some New Jersey Estuarine Sediments,
W79-05704 2L

Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

Benthic-Pelagic Coupling in the New York Bight,
W79-05706 5C

OUTER CONTINENTAL SHELF

Benthic Colonization Processes--A Review and a Proposed New Model,
W79-05707 5C

Antimicrobial Resistant Bacteria in the New York Bight,
W79-05708 5C

Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

Distribution and Abundance of Inshore Populations of the Surf Clam Spisula Solidissima,
W79-05710 5C

Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

Safe Shellfish from the Sea,
W79-05713 5C

The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation,
W79-05885 5C

Shorebird Dependence on Arctic Littoral Habitats,
W79-05886 5C

The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-05890 5C

Ecological Studies in the Northern Bering Sea: Studies of Seabirds in the Bering Strait,
W79-05891 5C

Ecological Studies of Colonial Seabirds at Cape Thompson and Cape Lisburne, Alaska,
W79-05892 5C

Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

Breeding and Population Ecology of Fulmars at Semidi Islands, Alaska, with Observations on the Reproduction of Sympatric Seabird Species,
W79-05895 5C

Studies of Marine Birds on Ugaiushak Island,
W79-05896 5C

The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

Dynamics of Marine Bird Populations on the Barren Islands, Alaska,
W79-05899 5C

Community Structure of Seabirds of Wooded Island, Alaska,
W79-05900 5C

The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

Catalog of Alaskan Seabird Colonies,
W79-05902 5C

Survey of Beached Marine Birds in Alaska,
W79-05903 5C

Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

The Distribution, Abundance, Diversity and Productivity of the Western Beaufort Sea Benthos,
W79-05906 5C

Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

Plant Communities of Alaskan Arctic Beaches,
W79-05910 5C

Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

Beaufort Sea Plankton Studies,
W79-05912 5C

Lower Cook Inlet Meroplankton,
W79-05913 5C

Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development on the Outer Continental Shelf of Alaska,
W79-05914 5C

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea,
W79-05916 5C

Bering Sea Ice Edge Ecosystem Study: Nutrient Cycling and Organic Matter Transfer,
W79-05917 5C

Report on Zooplankton Community Grazing Experiments Conducted on Board the NOAA Ship, Discoverer, in the Bering Sea, May-June 1977,
W79-05918 5C

Bibliography on the Transfer of Synthesized Organic Matter to Zooplankton, Micronekton, and Ichthyoplankton,
W79-05919 5C

Nutrient Dynamics in Nearshore Under-Ice Waters,
W79-05920 5C

Effects of Oiling on Temperature Regulation in Sea Otters,
W79-05921 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

Effects of Petroleum Exposure on the Breeding Ecology of the Gulf of Alaska Herring Gull Group and Reproductive Ecology of Large Gulls in the Northeast Gulf of Alaska,
W79-05923 5C

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

Composition and Source Identification of Organic Detritus in Lower Cook Inlet,
W79-05925 5C

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Overview and Synthesis,
W79-05927 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Avian Ecology in Simpson Lagoon, 1977,
W79-05928 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Ecology of Fishes in Simpson Lagoon, 1977,
W79-05929 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

OXIDATION

Seasonal Changes in Oxygen Uptake by Settled Particulate Matter and Sediments in a Marine Bay,
W79-05638 2L

OXIDATION-REDUCTION POTENTIAL

Redox Potentials in a Cropped Potato Processing Waste Water Disposal Field with a Deep Water Table,
W79-05822 5B

OXYGEN

Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

OXYGEN UPTAKE

Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

ACK ICE
The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

ALEOCLIMATOLOGY
Dry Climates--Past and Present,
W79-05570 2A

ARAMETER ESTIMATION
Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

ARATHION
Biological Hydrolysis of Parathion in Natural Ecosystems,
W79-05935 5B

Metabolism of Nitrophenols in Flooded Soils,
W79-05936 5A

AROWAN-CEDAR CITY DRAINAGE BASIN
Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

ATENTS
Demineralization of Saline Waters: A Preliminary Discussion of a Research Program,
W79-05655 3A

Water Treatment,
W79-05948 5D

Process for Protecting Asbestos-Cement Bearing Surfaces in Recirculating Cooling Water Systems,
W79-05949 8F

Sewage Osmosis System,
W79-05950 5D

Cam-Lock Water Gate,
W79-05951 8C

Sprinkler Nozzle,
W79-05952 3F

Casing Mounted Emitter,
W79-05953 3F

Drive Means for Irrigation System,
W79-05954 3F

Method and Apparatus for Removing Filterable Substances from a Liquid,
W79-05955 5D

Removing Coagulable Substances from an Aqueous Medium,
W79-05956 5D

Process and Apparatus for Removal of Contaminants from Water,
W79-05957 5D

Seawater Distillation Apparatus,
W79-05958 3A

Dual-Function Valve,
W79-05959 3F

Adjustable Bubbler Sprinkler Head,
W79-05960 3F

Apparatus for Removing Rainbows from Flowing Water,
W79-05961 5G

Sewage Treating and Conversion Process,
W79-05962 5D

Wastewater Treatment,
W79-05963 5D

PATH OF POLLUTANTS
Dye-Dispersion Study at Proposed Pumped-Storage Project on Hudson River at Cornwall-on-the-Hudson, New York,
W79-05596 5B

Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

Trace Metal Transport from Mining, Milling, and Smelting Watersheds,
W79-05858 5B

Chemical, Physical, Biochemical, and Bacteriological Characteristics at Selected Stream Sites in Puerto Rico, 1967-77,
W79-05967 7A

Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

PATHOLOGY
Morbidity and Mortality of Marine Mammals,
W79-05668 5C

An Amendment to RU232 Trophic Relationships Among Ice Inhabiting Phocid Seals, and RU230 Natural History of Ringed and Bearded Seals,
W79-05672 5C

Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea,
W79-05916 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

PEAK DISCHARGE
Subsidence of Peak Flow in Channels with Storage Areas,
W79-05541 2E

Flood Plain Information: Maxwell Creek, Parker, Texas,
W79-05719 2E

PENAEUS STYLIROSTRIS
The Culture of the Diatom Chaetoceros Gracilis and Its Use as a Food for Penaeid Protozoeal Larvae,
W79-05738 5C

PENAEUS VANNAMEI
The Culture of the Diatom Chaetoceros Gracilis and Its Use as a Food for Penaeid Protozoeal Larvae,
W79-05738 5C

PERCEPTIONS
The Perception and Valuation of Water Quality: A Review of Research Method and Findings,
W79-05723 6B

PERCOLATION BASINS
Local Infiltration of Storm Water,
W79-05550 4A

PERIGLACIAL ZONE
Problems of the Periglacial Zone (Zagadnienia Strefy Peryglacjalnej),
W79-05545 2C

PERMEABILITY
Estimation of Transmissivity and Permeability in Swedish Bedrocks,
W79-05551 2F

Freezing Process Studies,
W79-05653 3A

PERMSELECTIVE MEMBRANES
Theoretical Studies of the Behavior of Ions in Aqueous Solutions of Mixed Electrolytes with Respect to Osmionic Operation,
W79-05647 3A

PERSISTENCE
Persistence and Orographic Modulation of Mesoscale Precipitation Areas in a Potentially Unstable Warm Sector,
W79-05855 2B

PETROLEUM HYDROCARBONS
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

PETROLEUM TRANSPORT
Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

PHENOLOGY
Ecological Studies of the Annual Red Alga Dumontia Ncrassata (O.F. Muller) Lamouroux,
W79-05618 5C

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-05890 5C

Breeding and Population Ecology of Fulmars at Semidi Islands, Alaska, with Observations on the Reproduction of Sympatric Seabird Species,
W79-05895 5C

PHOSPHORUS
Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

Chemistry of Phosphorus, Cadmium, Copper, Nickel, Lead, and Zinc in Indiana Lake and Reservoir Sediments,
W79-05794 5B

Electron Probe Microanalytical Studies of Phosphorus Distribution Within Soil Fabric,
W79-05809 2G

Electron Probe Microanalysis of Calcite Grains Containing Phosphorus in Soil,
W79-05810 2G

PHYTOPLANKTON
An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

A Review of Phytoplankton Studies in Lake Livingston, Texas,
W79-05806 5C

Bering Sea Ice Edge Ecosystem Study: Nutrient Cycling and Organic Matter Transfer,
W79-05917 5C

PIPES
Wave Forces on Cylinders Near Plane Boundaries,
W79-05532 2L

PITTING
Corrosion of Metals in Sea Water,
W79-05870 3A

PLAINS
Hydrology and Water Control on Large Plains,
W79-05526 2A

PLANKTON
Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

Beaufort Sea Plankton Studies,
W79-05912 5C

Lower Cook Inlet Meroplankton,
W79-05913 5C

Bibliography on the Transfer of Synthesized Organic Matter to Zooplankton, Micronekton, and Ichthyoplankton,
W79-05919 5C

Nutrient Dynamics in Nearshore Under-Ice Waters,
W79-05920 5C

Composition and Source Identification of Organic Detritus in Lower Cook Inlet,
W79-05925 5C

PLANNING
Nonpoint Source Pollution,
W79-05582 5B

Economics of Water Development in Less Developed Countries,
W79-05750 6B

A Print-Plot Display System for a Linear Programming-Based Resources Planning Model,
W79-05797 6A

PLATTE RIVER
Comparison of Evapotranspiration Rates in the Platte River in Nebraska: 1938 vs 1978,
W79-05798 2D

PLUMES
Two-Dimensional Bubble Plumes,
W79-05539 8B

POCKET CALCULATORS
Flow Profiles in Trapezoidal Channels by Pocket Calculators,
W79-05538 8B

POISONS
Economic Impact of Proposed Amendments to Water Pollution Regulations, R77-12, Docket A.
W79-05753 6E

POLICY
Standard Setting and the Theory of Institutional Choice: The Case of Pollution Control,
W79-05749 6C

POLITICAL CONSTRAINTS
Standard Setting and the Theory of Institutional Choice: The Case of Pollution Control,
W79-05749 6C

POLLUTANT IDENTIFICATION
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

The Occurrence of Organochlorine Residues in Rainwater,
W79-05848 5A

Technology and Economics of Industrial Pollution Abatement,
W79-05865 5B

POLLUTANTS
Detection of Heavy Metal Pollution in Estuarine Sediments,
W79-05850 5B

POLLUTION TAXES (CHARGES)
Standard Setting and the Theory of Institutional Choice: The Case of Pollution Control,
W79-05749 6C

POLYCHLORINATED BIPHENYLS
Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

The Occurrence of Organochlorine Residues in Rainwater,
W79-05848 5A

POLYMERS
Drag Reduction in Sewers: First Results from a Permanent Installation,
W79-05543 8B

POPULATION
Middle Atlantic Fisheries: Recent Changes in Populations and Outlook,
W79-05700 5C

POPULATION DYNAMICS
Mathematical Model and Computer Simulation of the Population Dynamics of Zooplankton in Lake and Estuary Ecosystems,
W79-05739 5C

POPULATION STRUCTURE
Studies of Marine Birds on Ugaiushak Island,
W79-05896 5C

POROSITY
Freezing Process Studies,
W79-05653 3A

POROUS MEDIA
Freezing Process Studies,
W79-05653 3A

Feasibility Study for Development of a Transient Three-Dimensional Groundwater Flow Model Utilizing the Finite Element Method,
W79-05799 2F

POST IMPOUNDMENT
Evaluation of Planning for Fish and Wildlife, Lake Sharpe Reservoir Project,
W79-05717 6G

POTABLE WATER
Health Hazards from Drinking-Water.
W79-05726 5A

Preliminary Design of an Experimental Containerized Freeze Desalination Unit,
W79-05727 3A

POTENTIAL WATER SUPPLY
Potential Use of Converted Sea Water for Irrigation in Parts of California and Texas,
W79-05645 3A

POTENTIOMETRIC LEVEL
Injection of Water Into Wells for Investigation of Limited Aquifer,
W79-05552 4B

Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

Potentiometric Surface of Floridan Aquife
Southwest Florida Water Management Distric
and Adjacent Areas, September 1978,
W79-05983 7

POTOMAC ESTUARY MODEL
A Demonstration of Areawide Water Resource
Planning--Users Manual,
W79-05715 6

POWERPLANTS
Evaluation of Proposed TG and E (Tucson G
and Electric Company) Wastewater Discharg
on Groundwater in the Tucson Basin,
W79-05519 5

A Mathematical Model of the Interactions of
Aquatic Ecosystem and a Thermal Power St
tion Cooling System,
W79-05781 5

PRE-TRANS-ALASKA PIPELINE
Benthic Invertebrates in a North-Flowi
Stream and a South-Flowing Stream, Broo
Range, Alaska,
W79-05965 2

PRE-TREATMENT (WATER)
Removal of Scale-Forming Compounds fro
Sea Water,
W79-05578 3

Investigation of Chelation as a Means of Remo
ing Ions from Sea Water,
W79-05868 3

PRECIPITATION (ATMOSPHERIC)
Computation of the Average Precipitation Ov
the Western Part of Peninsular India During t
Summer Monsoon From the Continuity Equ
tion for Atmospheric Water Vapour,
W79-05619 2

Acid Precipitation in the New York Metropo
tan Area: Its Relationship to Meteorologic
Factors,
W79-05626 2

Persistence and Orographic Modulation of M
soscale Precipitation Areas in a Potentially U
stable Warm Sector,
W79-05855 2

Probable Maximum Precipitation Estimat
United States East of the 105th Meridian,
W79-05863 2

Precipitation and Throughfall Chemistry in t
San Francisco Bay Area,
W79-05937 5

PRECIPITATION EXCESS
A Study of Large Floods in the Thambrapar
River in Tamil Nadu,
W79-05629 2

PRESSURE
Demineralization of Saline Water Through Pr
surization Cycles with Ion Exchange Materia
W79-05580 3

PRESSURIZATION CYCLES
Demineralization of Saline Water Through Pr
surization Cycles with Ion Exchange Materia
W79-05580 3

PRETREATMENT REQUIREMENTS
Parametric Study on Brackish Water Membra
Desalting Plants,
W79-05501 3

PRIMARY PRODUCTIVITY
A Review of Phytoplankton Studies in La
Livingston, Texas,
W79-05806 5

Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

Bering Sea Ice Edge Ecosystem Study: Nutrient Cycling and Organic Matter Transfer,
W79-05917 5C

Nutrient Dynamics in Nearshore Under-Ice Waters,
W79-05920 5C

ROBABILITY
Probable Maximum Precipitation Estimates, United States East of the 105th Meridian,
W79-05863 2B

ROBABLE MAXIMUM PRECIPITATION
Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

Probable Maximum Precipitation Estimates, United States East of the 105th Meridian,
W79-05863 2B

ROBLEM IDENTIFICATION AND RANKING
Perils of the Orderly Mind: Cost-Benefit Analysis and Other Logical Pitfalls,
W79-05751 6B

RODUCTIVITY
A Conceptual Representation of the New York Bight Ecosystem,
W79-05696 5B

Phytoplankton Productivity in the Apex of the New York Bight: Environmental Regulation of Productivity/Chlorophyll A,
W79-05697 5B

ROJECT PLANNING
Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

ROJECT POST-EVALUATION
The Founding of the Salt River Water Users Association,
W79-05555 6E

ROPOSED DEVELOPMENT PROGRAM
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

ROTEINS
Removing Coagulable Substances from an Aqueous Medium,
W79-05956 5D

UBLIC GOODS
Congestion, Pollution, and Impure Public Goods,
W79-05748 6C

UBLIC HEALTH
Safe Shellfish from the Sea,
W79-05713 5C

Health Hazards from Drinking-Water.
W79-05726 5A

UBLICATIONS
Bibliography of Publications on Compounds of Gas Hydrate Type,
W79-05572 10C

Estuarine Research: An Annotated Bibliography of Selected Literature, With Emphasis on the Hudson River Estuary, New York and New Jersey,
W79-05593 2L

Corrosion of Metals in Sea Water,
W79-05870 3A

PUERTO RICO
Summary of the Water Resources of Puerto Rico,
W79-05592 6D

Chemical, Physical, Biochemical, and Bacteriological Characteristics at Selected Stream Sites in Puerto Rico, 1967-77,
W79-05967 7A

PULP AND PAPER INDUSTRY
Sludge-Dewatering Techniques Must Meet Pollution Control Requirements,
W79-05506 5E

Membrane Processes for Environmental Studies,
W79-05735 5D

PULP WASTES
Follum (Fabrikker A/S., Norway) has Fulfilled Antipollution Demands (Follum har oppfylt utslippskravene),
W79-05504 5D

Tough Environmental Requirements Demand New Approaches to Landfill,
W79-05505 5E

Combined Effluents from Three Mills are Handled by Single New Facility,
W79-05507 5D

RADIOACTIVE DATING
Tritium Dating of Some Groundwater Samples from Northwestern Iraqi Desert,
W79-05569 2F

The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

RADIOACTIVE WASTE DISPOSAL
Installation of Water- and Gas-Sampling Wells in Low-Level Radioactive-Waste Burial Trenches, West Valley, New York,
W79-05970 5B

RADIOACTIVE WELL LOGGING
Geologic and Geophysical Data from Osceola National Forest, Florida,
W79-05605 5A

RAIN GAGES
Design of a Reliable, Inexpensive Recording Rain Gage Which Utilizes Solid-State Memory,
W79-05793 7B

An Automatic Sequential Rain Sampler,
W79-05847 7B

RAIN WATER
The Occurrence of Organochlorine Residues in Rainwater,
W79-05848 5A

RAINFALL
Some Results from Urban Runoff Studies in Bergsjon Goteborg,
W79-05548 2A

A Statistical Study of the Annual Rainfall in the Sutlej Catchment and Annual Run-Off at Bhakra Dam Site,
W79-05628 2B

A Study of Large Floods in the Thambraparani River in Tamil Nadu,
W79-05629 2E

An Analytical Model of Rainfall Interception by Forests,
W79-05854 2D

Persistence and Orographic Modulation of Mesoscale Precipitation Areas in a Potentially Unstable Warm Sector,
W79-05855 2B

RAINFALL INTENSITY
The Relationship Between Economic Development and Ecological Degradation: How Degradation has Occurred in West Africa and How Its Progress Might be Halted,
W79-05565 6B

Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

An Automatic Sequential Rain Sampler,
W79-05847 7B

RAINFALL RATES
Probable Maximum Precipitation Estimates, United States East of the 105th Meridian,
W79-05863 2B

RECREATION
Review Report on Umpqua River and Tributaries, Oregon, Interim Report, South Umpqua River, Volume III; (Appendix B--Hydrology, Meteorology, and Reservoir Regulation; Appendix C--Foundation and Materials Data; Appendix D--Recreation, Public Use, and Environment),
W79-05616 8A

Impacts of Recreation on Riparian Soils and Vegetation,
W79-05843 4C

RECREATION WASTES
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

RED RIVER OF THE NORTH BASIN (MN)
Accomplishment Plan, Region VIII. Red River of the North Basin.
W79-05722 5G

REGIONAL ANALYSIS
Physiography and Surficial Geology of the Copper-Nickel Study Region, Northeastern Minnesota,
W79-05984 7C

REGIONAL PLANNING
Selected Priorities: 1978-82--A First-Year Effort Recommending Priorities for Selected Federal Water and Related Land Resource Programs in New England.
W79-05724 6E

REGRESSION ANALYSIS
Application of Ridge Regression Analysis to Water Resources Studies,
W79-05853 2A

REGULATION
River Runoff Regulation and Water-Management Calculations, (Metodika Regulirovaniya Stoka i Vodokhozyaistvennykh Raschetov),
W79-05544 4A

An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

Economic Impact of Proposed Amendments to Water Pollution Regulations, R77-12, Docket A.
W79-05753 6E

Implementation of Section 316 of the Federal Water Pollution Control Act,
W79-05755 5C

Regulatory Developments in Section 316(b),
W79-05757 5C

REGULATIONS
The Effect of Water Pollution Control Regulations on the Cost of Production of Electric Power,
W79-05796 6B

REMOTE SENSING
Estimation of Snow Temperature and Mean Crystal Radius From Remote Multispectral Passive Microwave Measurements,
W79-05518 2C

The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

Eastern-Western Arctic Sea Ice Analyses,
W79-05613 2C

Lake Erie Ice: Winter 1975-76,
W79-05615 2C

Application of LANDSAT Imagery for Snow Mapping in Norway,
W79-05617 7B

Comparison of 2.8- and 21-Cm Microwave Radiometer Observations over Soils with Emission Model Calculations,
W79-05633 7B

Applications of Remote Sensing to Water Resources,
W79-05840 7B

Proceedings for Gathering Ground Truth Information for a Supervised Approach to a Computer-Implemented Land Cover Classification of Landsat-Acquired Multispectral Scanner Data,
W79-05859 7B

Quantitative Analysis of Aircraft Multispectral-Scanner Data and Mapping of Water-Quality Parameters in the James River in Virginia,
W79-05862 7B

Flight Path Curvature Distortion in Side-Looking Airborne Radar Imagery,
W79-05973 7B

Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

REPRODUCTION
Ecological Studies of the Annual Red Alga Dumontia Ncrassata (O.F. Muller) Lamouroux,
W79-05618 5C

Breeding and Population Ecology of Fulmars at Semidi Islands, Alaska, with Observations on the Reproduction of Sympatric Seabird Species,
W79-05895 5C

Effects of Petroleum Exposure on the Breeding Ecology of the Gulf of Alaska Herring Gull Group and Reproductive Ecology of Large Gulls in the Northeast Gulf of Alaska,
W79-05923 5C

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

RESEARCH AND DEVELOPMENT
Swedish Urban Hydrological Research: A Review,
W79-05547 4C

RESEARCH PRIORITIES
Economics of Water Development in Less Developed Countries,
W79-05750 6B

RESERVOIR STORAGE
Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

RESERVOIRS
Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

Earth Dams and Reservoirs,
W79-05612 2H

Seasonal Cycling of Cesium-137 in a Reservoir,
W79-05622 5B

Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

A Compendium of Lake and Reservoir Data Collected by the National Eutrophication Survey in the Central United States.
W79-05732 5C

A Compendium of Lake and Reservoir Data Compiled by the National Eutrophication Survey in the Western United States.
W79-05733 5C

A Review of Phytoplankton Studies in Lake Livingston, Texas,
W79-05806 5C

RESOURCE ALLOCATION
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

RESOURCES
An Outline of Soil, Water and Agriculture in Arab Countries,
W79-05553 2A

RESOURCES DEVELOPMENT
Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5C

Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5B

Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Avian Ecology in Simpson Lagoon, 1977,
W79-05928 5C

RESPIRATION
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

RESUSPENSION
Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

REVERSE OSMOSIS
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

The Mechanism of Desalination by Reverse Osmosis,
W79-05878 3A

Study of Oriented Cellulose Membranes for Reverse Osmosis and the Relationship Between Morphology and Salt Rejection,
W79-05879 3A

REVIEWS
Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

A Review of Phytoplankton Studies in Lake Livingston, Texas,
W79-05806 5C

Impacts of Recreation on Riparian Soils and Vegetation,
W79-05843 4C

RHYACODRILUS SODALIS
Importance of Algae in the Diet of the Oligochaetes Lumbriculus Variegatus (Muller) and Rhyacodrulus Sodalis (Eisen),
W79-05517 5C

RICE
Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

RICHELIA INTRACELLULARIS
An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

RIO BLANCO COUNTY
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

RIPARIAN LAND
Impacts of Recreation on Riparian Soils and Vegetation,
W79-05843 4C

RIVER BASIN DEVELOPMENT
Selected Priorities: 1978-82--A First-Year Effort Recommending Priorities for Selected Federal Water and Related Land Resource Programs in New England.
W79-05724 6B

RIVER BASINS
Synthesis and Calibration of a River Basin Water Management Model,
W79-05583 6B

Selected Priorities: 1978-82--A First-Year Effort Recommending Priorities for Selected Federal Water and Related Land Resource Programs in New England.
W79-05724 6B

RIVERS
River Runoff Regulation and Water-Management Calculations, (Metodika Regulirovaniya Stoka i Vodokhozyaistvennykh Raschetov),
W79-05544 4A

The Modeling of Tidal Flow in a Channel Using a Turbulence Energy Closure Scheme,
W79-05637 2E

Physical Measurement of Ice Jams, 1976-77 Field Season,
W79-05833 2C

Possible Mechanisms for Leakage Between Aquifers and Rivers,
W79-05851 2F

River Ice,
W79-05860 2C

ROCKY MOUNTAIN REGION
A Compendium of Lake and Reservoir Data Compiled by the National Eutrophication Survey in the Western United States.
W79-05733 5C

ROUGHNESS (HYDRAULIC)
A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

RUNOFF
River Runoff Regulation and Water-Management Calculations, (Metodika Regulirovaniya Stoka i Vodokhozyaistvennykh Raschetov),
W79-05544 4A

Application of LANDSAT Imagery for Snow Mapping in Norway,
W79-05617 7B

A Statistical Study of the Annual Rainfall in the Sutlej Catchment and Annual Run-Off at Bhakra Dam Site,
W79-05628 2B

Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: II. Nitrogen and Chloride Transport in Runoff,
W79-05642 5B

Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

RUNOFF FORECASTING
The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

SAFETY
The Care of Explosives,
W79-05998 8H

SALINE WATER
Land and Water Use in Saudi Arabia,
W79-05561 5G

Potential for Using Saline Waste Water from Electrical Power Plants for Irrigation,
W79-05829 3C

Corrosion of Metals in Sea Water,
W79-05870 3A

SALINE WATER-FRESHWATER INTERFACES
An Analysis of the Groundwater Resources of Tongatapu Island, Kingdom of Tonga,
W79-05827 2F

SALINITY
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

Grapefruit Response to Variable Salinity in Irrigation Water and Soil,
W79-05814 3C

SALMONELLA
Effect of Environmental Factors on Survival of Salmonella Typhimurium in Soil,
W79-05807 5B

SALT BALANCE
Part I: Survey of Physiological Mechanisms of Sodium and Chloride Ion Transport and Design of Experiment for Application to Demineralizing Saline Waters - Part II: Laboratory Evaluation of Use of Algae in Saline Water Conversion -- Phase I Final Report,
W79-05648 3A

SALT MARSHES
Plant Communities of Alaskan Arctic Beaches,
W79-05910 5C

SALT TOLERANCE
Salt Tolerance in the Wild Relatives of the Cultivated Tomato: Responses of Solanum Pennellii to High Salinity,
W79-05813 2I

SAMPLING
National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

Groundwater Sampling in Uranium Reconnaissance,
W79-05521 5A

Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

Evaluation of Ichthyoplankton Sampling Gear Used in Power Plant Entrainment Studies,
W79-05759 5C

Monitoring Areawide Rural Water Quality,
W79-05842 5A

Installation of Water- and Gas-Sampling Wells in Low-Level Radioactive-Waste Burial Trenches, West Valley, New York,
W79-05970 5B

SANTA CRUZ RIVER
Evaluation of Proposed TG and E (Tucson Gas and Electric Company) Wastewater Discharge on Groundwater in the Tucson Basin,
W79-05519 5E

SARGASSUM SWARTZII
Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

SATELLITES (ARTIFICIAL)
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

SAUDI ARABIA
Land and Water Use in Saudi Arabia,
W79-05561 5G

SCALING
Investigation of Chelation as a Means of Removing Ions from Sea Water,
W79-05868 3A

SCREENS
Impingement Survival Studies on White Perch, Striped Bass, and Atlantic Tomcod at Three Hudson River Power Plants,
W79-05772 5C

Survival of Fishes and Macroinvertebrates Impinged at Oyster Creek Generating Station,
W79-05773 5C

An Analysis of Factors Influencing the Impingement of Threadfin Shad at Power Plants in the Southeastern United States,
W79-05774 5C

Comparative Fish Impingement at Two Adjacent Water Intakes on the Mid-Columbia River,
W79-05775 5C

Statistical Comparison and Choices of Sampling Designs for Estimating Fish Impingement at Cooling Water Intakes,
W79-05776 5C

Temporally Stratified Sampling Programs for Estimation of Fish Impingement,
W79-05777 5C

A Conceptual Model of Causal Factors Regarding Gizzard Shad Runs at Steam Electric Power Plants,
W79-05778 5C

SEA ICE
Eastern-Western Arctic Sea Ice Analyses,
W79-05613 2C

A Large-Scale Numerical Model of Sea Ice,
W79-05632 2C

SEA WATER
Melting of Ice in Sea Water: A Primitive Model with Application to the Antarctic Ice Shelf and Icebergs,
W79-05857 2C

Corrosion of Metals in Sea Water,
W79-05870 3A

Seawater Distillation Apparatus,
W79-05958 3A

SEASONAL
The Relationship Between Economic Development and Ecological Degradation: How Degradation has Occurred in West Africa and How Its Progress Might be Halted,
W79-05565 6B

Ecological Studies of the Annual Red Alga Dumontia Ncrassata (O.F. Muller) Lamouroux,
W79-05618 5C

Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

SECONDARY HEAT TRANSFER MEDIA
Vapor Compression with Secondary Heat-Transfer Media.
W79-05873 3A

SEDIMENT CONCENTRATION
Statistical Analysis of Concentration Records,
W79-05535 2J

Effects of Hindered Settling on Sediment Concentration Profiles,
W79-05542 2J

SEDIMENT CONTROL
Sediment Management Concepts in Urban Storm Water System Design,
W79-05981 4A

SEDIMENT LOAD
Erosion Control/Sediment Modeling--Southern Idaho a Progress Report,
W79-05804 2J

SEDIMENT TRANSPORT
Dust Storms and Their Geomorphological Implications,
W79-05559 2J

Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

Suspended Particulate Concentrations and Compositions in the New York Bight,
W79-05687 5C

Developmental Tests on the Use of Fluorescent Tracers and Backwash Sediment-Load Samplers to Measure the Beach Drift Component of Littoral Transport at Sandy Hook, New Jersey,
W79-05688 2J

Longshore Transport at a Total Littoral Barrier,
W79-05838 2H

Sediment Management Concepts in Urban Storm Water System Design,
W79-05981 4A

SEDIMENT-WATER INTERFACES
Chemistry of Phosphorus, Cadmium, Copper, Nickel, Lead, and Zinc in Indiana Lake and Reservoir Sediments,
W79-05794 5B

SEDIMENTATION
Earth Dams and Reservoirs,
W79-05612 2H

Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

SEDIMENTS
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

Statistical Analysis of Concentration Records,
W79-05535 2J

Effects of Hindered Settling on Sediment Concentration Profiles,
W79-05542 2J

Seasonal Cycling of Cesium-137 in a Reservoir,
W79-05622 5B

Sources and Fates of Aromatic Compounds in Urban Stormwater Runoff,
W79-05627 5A

Spatial and Temporal Variation in Sedimentary Grain-Size Facies and Sediment Heavy Metal Ratios in the New York Bight Apex,
W79-05686 5C

Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

Bacterial Flux in Some New Jersey Estuarine Sediments,
W79-05704 2L

Antimicrobial Resistant Bacteria in the New York Bight,
W79-05708 5C

The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

SEPARATION TECHNIQUES
Water Extraction from Black Liquors (Ekstraktsiya vody iz rastvorov chernogo shcheloka),
W79-05502 5D

Research on Condensation Mechanisms,
W79-05882 3A

Method and Apparatus for Removing Filterable Substances from a Liquid,
W79-05955 5D

Removing Coagulable Substances from an Aqueous Medium,
W79-05956 5D

SEPTIC TANKS
Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

Transport of Antibiotic-Resistant Escherichia Coli Through Western Oregon Hillslope Soils Under Conditions of Saturated Flow,
W79-05932 5B

Effect of Septic Tank Effluent on the Base Status of Two Tile-Drained Soils,
W79-05945 5B

SETTLING VELOCITY
Effects of Hindered Settling on Sediment Concentration Profiles,
W79-05542 2J

SEWAGE DISPOSAL
Influence of Non-Point Pollution Sources in Connection with the Tuy River Basin Sanitation Studies,
W79-05740 5A

Economic Impact of Proposed Amendments to Water Pollution Regulations, R77-12, Docket A.
W79-05753 6E

SEWAGE EFFLUENT
Adsorption of Virus on Activated Carbon Under Varying Water Chemistry Conditions,
W79-05831 5D

The Uptake of 203Hg-Labeled Mercury Compounds by Bromegrass from Irrigated Undisturbed Soil Columns,
W79-05943 5B

SEWAGE EFFLUENTS
Effluent Irrigation of Coastal Bermuda Grass,
W79-05624 3C

Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water,
W79-05643 5B

Effect of Septic Tank Effluent on the Base Status of Two Tile-Drained Soils,
W79-05945 5B

SEWAGE SLUDGE
Extractability of Cadmium, Copper, Nickel, and Zinc by Double Acid Versus DTPA and Plant Content at Excessive Soil Levels,
W79-05946 5B

SEWAGE TREATMENT
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

Sewage Osmosis System,
W79-05950 5D

Sewage Treating and Conversion Process,
W79-05962 5D

SEWERS
Drag Reduction in Sewers: First Results from a Permanent Installation,
W79-05543 8B

SHELLFISH
Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

Safe Shellfish from the Sea,
W79-05713 5C

Lower Cook Inlet Meroplankton,
W79-05913 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices
W79-05922 5C

SHRIMP
The Culture of the Diatom Chaetoceros Gracili and Its Use as a Food for Penaeid Protozoea Larvae,
W79-05738 5C

SIERRA NEVADA MOUNTAINS
The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

SIMULATION
Synthesis and Calibration of a River Basi Water Management Model,
W79-05583 6

SIMULATION ANALYSIS
Mathematical Model and Computer Simulatio of the Population Dynamics of Zooplankton i Lake and Estuary Ecosystems,
W79-05739 5

SITES
Installation of Water- and Gas-Sampling Wel in Low-Level Radioactive-Waste Burial Trench es, West Valley, New York,
W79-05970 5

SLUDGE TREATMENT
Sludge-Dewatering Techniques Must Meet Po lution Control Requirements,
W79-05506 5

SNAKE RIVER BASIN
Water Resources Data for Wyoming, Wat Year 1977--Volume 2. Green River Basin, Be River Basin, Snake River Basin,
W79-05599 7

OW
now and Ice in the Phosphorus Budget of a ake in South Central Ontario,
V79-05620 2C

OW COVER
stimation of Snow Temperature and Mean rystal Radius From Remote Multispectral Pas- ve Microwave Measurements,
V79-05518 2C

pplication of LANDSAT Imagery for Snow lapping in Norway,
V79-05617 7B

OWCOVERED AREAS
he Use of Snowcovered Area in Runoff Fore- asts,
V79-05611 2C

OWMELT
he Use of Snowcovered Area in Runoff Fore- asts,
V79-05611 2C

CIAL VALUES
he Perception and Valuation of Water Quality: Review of Research Method and Findings,
V79-05723 6B

IL ANALYSIS
lectron Probe Microanalytical Studies of Phos- horus Distribution Within Soil Fabric,
V79-05809 2G

lectron Probe Microanalysis of Calcite Grains ontaining Phosphorus in Soil,
V79-05810 2G

oncentrations of Metals in Very Small Vol- mes of Soil Solution,
V79-05976 7B

IL BACTERIA
ffect of Environmental Factors on Survival of almonella Typhimurium in Soil,
V79-05807 5B

IL CHEMISTRY
ation Exchange Equilibria in a Mixed Soil ystem Containing Three Heterovalent Cations,
V79-05808 2G

IL CONTAMINATION
inc and Cadmium Contents of Agricultural oils and Corn in Northwestern Indiana,
V79-05947 5B

IL DISPOSAL FIELDS
ewage Osmosis System,
V79-05950 5D

IL EROSION
he Relationship Between Economic Develop- ent and Ecological Degradation: How Degra- ation has Occurred in West Africa and How Its rogress Might be Halted,
V79-05565 6B

nfluence of Non-Point Pollution Sources in onnection with the Tuy River Basin Sanitation tudies,
V79-05740 5A

rosion Control/Sediment Modeling--Southern daho a Progress Report,
V79-05804 2J

IL MOISTURE
omparison of 2.8- and 21-Cm Microwave Radi- meter Observations over Soils with Emission odel Calculations,
V79-05633 7B

ielectric Constants of Soils at Microwave Fre- uencies--II,
V79-05861 2G

SOIL PHYSICAL PROPERTIES
Effects of Water Management and Soil Physical Properties on Cotton Production in the Rolling Plains,
W79-05557 3F

SOIL PROFILES
Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: I. Nitrate-Nitrogen and Chloride Distribution in Soil Profiles,
W79-05641 5B

SOIL SOLUTIONS
Concentrations of Metals in Very Small Volumes of Soil Solution,
W79-05976 7B

SOIL WATER
Effect of Septic Tank Effluent on the Base Status of Two Tile-Drained Soils,
W79-05945 5B

Concentrations of Metals in Very Small Volumes of Soil Solution,
W79-05976 7B

SOIL-WATER-PLANT RELATIONSHIPS
Effects of Water Management and Soil Physical Properties on Cotton Production in the Rolling Plains,
W79-05557 3F

SOILS
Dielectric Constants of Soils at Microwave Frequencies--II,
W79-05861 2G

SOLAR DISTILLATION
Producing Selectively Infrared-Reflecting Surfaces on Plastic Films for Solar Stills,
W79-05659 3A

Development of Plastics Solar Stills.
W79-05660 3A

SOLAR STILLS
Research Investigations of Multiple-Effect Evaporation of Saline Waters by Steam from Solar Radiation,
W79-05573 3A

Producing Selectively Infrared-Reflecting Surfaces on Plastic Films for Solar Stills,
W79-05659 3A

Development of Plastics Solar Stills.
W79-05660 3A

SOLID WASTES
Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

SOLITARY WAVES
A Note on the Internal Solitary Waves Produced by Tidal Flow Over a Three-Dimensional Ridge,
W79-05631 2L

SOLVATION
The Study of Ionic Solvation,
W79-05658 1A

SOLVENT EXTRACTION
Development of the Solvent Demineralization of Saline Water,
W79-05650 3A

SOLVENTS
Research on Role of Ligand Molecules on Ionization Potentials,
W79-05864 3A

SORPTION
Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

SOUTH-CENTRAL IOWA
Water Resources of South-Central Iowa,
W79-05609 7C

SOUTH UMPQUA RIVER (OR)
Review Report on Umpqua River and Tributaries, Oregon, Interim Report, South Umpqua River, Volume III; (Appendix B--Hydrology, Meteorology, and Reservoir Regulation; Appendix C--Foundation and Materials Data; Appendix D--Recreation, Public Use, and Environment),
W79-05616 8A

SOUTHEASTERN OKLAHOMA
Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

SOUTHERN POWDER RIVER BASIN (WYO)
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

SOUTHWEST US
A Compendium of Lake and Reservoir Data Compiled by the National Eutrophication Survey in the Western United States.
W79-05733 5C

SPATIAL DISTRIBUTION
Seasonal Distribution and Abundance of Bowhead and Beluga Whales in the Bering Sea and Arctic Ocean,
W79-05667 5C

Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

The Distribution, Abundance, Diversity and Productivity of the Western Beaufort Sea Benthos,
W79-05906 5C

Lower Cook Inlet Meroplankton,
W79-05913 5C

SPAWNING
Lower Cook Inlet Meroplankton,
W79-05913 5C

SPECIES RICHNESS
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters,
W79-05718 5C

SPOIL BANKS
Surficial Sediments of the NOAA-MESA Study Areas in the New York Bight,
W79-05685 5B

SPRINKLER IRRIGATION
Variability of Sprinkler Coefficient of Uniformity Test Results,
W79-05805 3F

A Note on the Economic Significance of Uniform Water Application,
W79-05816 3F

Center Pivot Irrigation in the Columbia Basin of Washington and Oregon: Dynamics and Implications,
W79-05818 3F

SPRINKLER IRRIGATION

Sprinkler Nozzle,
W79-05952 3F

Casing Mounted Emitter,
W79-05953 3F

Adjustable Bubbler Sprinkler Head,
W79-05960 3F

'Corner Pivot' An Effective Corner Watering System,
W79-05990 3F

Computer Model for Center Pivot Sprinkler Design,
W79-05994 3F

The Use of Computers to Nozzle Center Pivot Systems,
W79-05995 3F

Determining Center-Pivot Sprinkler Uniformities,
W79-05996 3F

Performance of Center-Pivot Sprinkler Irrigation Systems Operating at Reduced Pressures,
W79-05997 3F

STATISTICAL METHODS

Statistical Analysis of Concentration Records,
W79-05535 2J

STATISTICS

A Statistical Study of the Annual Rainfall in the Sutlej Catchment and Annual Run-Off at Bhakra Dam Site,
W79-05628 2B

STEADY FLOW

Supercritical Flow in Bends of Trapezoidal Section,
W79-05531 2E

A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

STORM DRAINS

Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

STORM RUNOFF

Geohydrological Research at the Chalmers University of Technology, Goteborg.
W79-05546 4C

Local Infiltration of Storm Water,
W79-05550 4A

Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

Stormwater Interception and Storage,
W79-05625 2E

Sources and Fates of Aromatic Compounds in Urban Stormwater Runoff,
W79-05627 5A

Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

Sediment Management Concepts in Urban Storm Water System Design,
W79-05981 4A

STORM SEWERS

Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

STORM WATER

Stormwater Interception and Storage,
W79-05625 2E

Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

STORM WATER MANAGEMENT

Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

STORMWATER MANAGEMENT MODEL (SWMM)

Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

STRATIFICATION

New York Bight Water Stratification--October 1974,
W79-05682 1A

STRATIGRAPHY

Geologic and Geophysical Data from Osceola National Forest, Florida,
W79-05605 5A

STREAM GAGING

Surface and Groundwater Study of the White River, Osawes County, Nebraska,
W79-05801 2A

STREAMFLOW

Selected Low-Flow Characteristics of Streams in the Vicinity of Warwick, Orange County, New York,
W79-05595 2E

STREAMS

Selected Low-Flow Characteristics of Streams in the Vicinity of Warwick, Orange County, New York,
W79-05595 2E

Stream Chemistry and Watershed Nutrient Economy Following Wildfire and Fertilization in Eastern Washington,
W79-05824 5B

The Suspended Sediment Regime of an Oregon Coast Range Stream,
W79-05846 2J

Chemical, Physical, Biochemical, and Bacteriological Characteristics at Selected Stream Sites in Puerto Rico, 1967-77,
W79-05967 7A

Modeling Nitrogen, Oxygen, Chattahoochee River, GA.,
W79-05974 5B

STRUCTURE

Study of Oriented Cellulose Membranes for Reverse Osmosis and the Relationship Between Morphology and Salt Rejection,
W79-05879 3A

STRUTHER WELLS-SCIENTIFIC DESIGN PROCESS

A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

SUBSIDENCE

Subsidence of Peak Flow in Channels with Storage Areas,
W79-05541 2E

SUBSURFACE DRAINAGE

Subsurface Drainage Model with Associated Sediment Transport,
W79-05802 2J

SUFFOLK COUNTY

Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

SUGAR BEETS

Timing and Rate of Fertilizer Nitrogen for Sugarbeets Related to Nitrogen Uptake and Pollution Potential,
W79-05939 5F

SULFUR DIOXIDE

Effects of SO2 and NO2 on Nitrification in Soil
W79-05940 5B

SUPERCRITICAL FLOW

Supercritical Flow in Bends of Trapezoidal Section,
W79-05531 2E

SUPERSATURATION

Investigation of Supersaturation in Saline Water Conversion,
W79-05872 3A

SURFACE DRAINAGE

Land and Water Use in Saudi Arabia,
W79-05561 5G

SURFACE WATER AVAILABILITY

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6B

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6B

Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6B

SURFACE WATERS

Quality of the Water in Borrow Ponds Near Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589

Water Resources Data for Wyoming, Water Year 1977--Volume 1. Missouri River Basin,
W79-05598

Water Resources Data for Wyoming, Water Year 1977--Volume 2. Green River Basin, Bear River Basin, Snake River Basin,
W79-05599

Water Resources of South-Central Iowa,
W79-05609

Water Resources of the Upper Duck River Basin, Central Tennessee,
W79-05985

Water Resources Data for Kansas, Water Year 1978,
W79-05989

SURVEYS

An Outline of Soil, Water and Agriculture in Arab Countries,
W79-05553

Middle Atlantic Fisheries: Recent Changes in Populations and Outlook,
W79-05700

Some Results of Fish Surveys in the Mid-Atlantic Important For Assessing Environmental Impacts,
W79-05701

SUSPENDED SOLIDS
Effects of Hindered Settling on Sediment Concentration Profiles,
W79-05542 2J

Solids Control in Effluents from Aerated Lagoon Systems,
W79-05828 5D

The Suspended Sediment Regime of an Oregon Coast Range Stream,
W79-05846 2J

SWAMP FORESTS
Community Structure, Dynamics and Nutrients Cycling in the Okefenokee Cypress Swamp-Forest,
W79-05746 5C

SWEDEN
Geohydrological Research at the Chalmers University of Technology, Goteborg.
W79-05546 4C

Swedish Urban Hydrological Research: A Review,
W79-05547 4C

Some Results from Urban Runoff Studies in Bergsjon Goteborg,
W79-05548 2A

Some Aspects on Urban Runoff Quality Modeling,
W79-05549 5B

Local Infiltration of Storm Water,
W79-05550 4A

Estimation of Transmissivity and Permeability in Swedish Bedrocks,
W79-05551 2F

Injection of Water Into Wells for Investigation of Limited Aquifer,
W79-05552 4B

TALLAHASSEE (FL)
Effluent Irrigation of Coastal Bermuda Grass,
W79-05624 3C

TAMA RIVER (JAPAN)
Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

TAMPA RESERVOIR
Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

TEMPERATURE
Regional Mean Bowen Ratios Deduced from Diurnal Changes of Temperature and Humidity,
W79-05883 2A

TEMPORAL DISTRIBUTION
Seasonal Distribution and Abundance of Bowhead and Beluga Whales in the Bering Sea and Arctic Ocean,
W79-05667 5C

A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity - Their Numbers and Seasonal Movements,
W79-05674 5C

Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

The Distribution, Abundance, Diversity and Productivity of the Western Beaufort Sea Benthos,
W79-05906 5C

Lower Cook Inlet Meroplankton,
W79-05913 5C

TENNESSEE
Walker Branch Watershed: Site Description and Research Scope,
W79-05837 2A

TERRAIN ANALYSIS
Flight Path Curvature Distortion in Side-Looking Airborne Radar Imagery,
W79-05973 7B

TERTIARY TREATMENT
Removal of Color, Detergents, and Other Refractory Substances from Textile Wastewater,
W79-05867 5D

TEXAS
Nitrates and Bacterial Distribution in Rural Domestic Water Supplies,
W79-05524 5B

Special Flood Hazard Information: Turkey Creek, Bryan, Texas.
W79-05716 2E

Flood Plain Information: Maxwell Creek, Parker, Texas,
W79-05719 2E

Flood Plain Information: Deer Creek and Tributaries, Crowley, Texas.
W79-05720 2E

TEXTILES
Membrane Processes for Environmental Studies,
W79-05735 5D

Removal of Color, Detergents, and Other Refractory Substances from Textile Wastewater,
W79-05867 5D

THAMBRAPARANI RIVER (INDIA)
A Study of Large Floods in the Thambraparani River in Tamil Nadu,
W79-05629 2E

THEORETICAL ANALYSIS
The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

Theoretical Studies of the Behavior of Ions in Aqueous Solutions of Mixed Electrolytes with Respect to Osmionic Operation,
W79-05647 3A

Perils of the Orderly Mind: Cost-Benefit Analysis and Other Logical Pitfalls,
W79-05751 6B

THERMAL POLLUTION
Ecological Bioenergetics of Physa Acuta (Gastropoda) in Heated Waters,
W79-05514 5C

THERMAL STRESS
Mortalities of the Larvae of Two Species of Bivalves after Acute Exposure to Elevated Temperature,
W79-05771 5C

THETFORD FOREST (EAST ANGLIA)
An Analytical Model of Rainfall Interception by Forests,
W79-05854 2D

THIN FILMS
Evaluation of a Thin-Film Sea Water Distillation Unit for Marine and Shore Base Application.
W79-05874 3A

TIDAL EFFECTS
Dye-Dispersion Study at Proposed Pumped-Storage Project on Hudson River at Cornwall-on-the-Hudson, New York,
W79-05596 5B

TIDAL FLATS
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters,
W79-05718 5C

TIDAL FLOW
The Modeling of Tidal Flow in a Channel Using a Turbulence Energy Closure Scheme,
W79-05637 2L

TIDAL POOLS
Ecological Studies of the Annual Red Alga Dumontia Ncrassata (O.F. Muller) Lamouroux,
W79-05618 5C

TIDAL WATERS
A Note on the Internal Solitary Waves Produced by Tidal Flow Over a Three-Dimensional Ridge,
W79-05631 2L

TIDES
A Note on the Internal Solitary Waves Produced by Tidal Flow Over a Three-Dimensional Ridge,
W79-05631 2L

TOMATOES
Salt Tolerance in the Wild Relatives of the Cultivated Tomato: Responses of Solanum Pennellii to High Salinity,
W79-05813 2I

TONGA
An Analysis of the Groundwater Resources of Tongatapu Island, Kingdom of Tonga,
W79-05827 2F

TONGATAPU ISLAND (TONGA)
An Analysis of the Groundwater Resources of Tongatapu Island, Kingdom of Tonga,
W79-05827 2F

TOXICITY
Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

TOXINS
Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

Disposal of a Large Quantity of Sodium Fluoroacetate in a Sanitary Landfill Site Located in an Aquifer Recharging Area,
W79-05835 5G

TRACE ELEMENTS
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

TRANSMISSIVITY
Estimation of Transmissivity and Permeability in Swedish Bedrocks,
W79-05551 2F

The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

TRANSPIRATION
Water Relations of Cadmium-Treated Plants,
W79-05934 2I

TRANSPORT DEPLETION
Demineralization by Transport Depletion,
W79-05876 3A

TREATMENT FACILITIES
Follum (Fabrikker A/S., Norway) has Fulfilled Antipollution Demands (Follum har oppfylt utslippskravene),
W79-05504 5D

Growth Effects of Major Land Use Projects (Wastewater Facilities), Volume I: Model Specification and Causal Analysis,
W79-05866 6G

TRICKLE IRRIGATION
Analysis of Trickle Irrigation with Application to Design Problems,
W79-05815 3F

TRITIUM
Tritium Dating of Some Groundwater Samples from Northwestern Iraqi Desert,
W79-05569 2F

TROPHIC RELATIONSHIPS
Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

TUCSON (AZ)
Evaluation of Proposed TG and E (Tucson Gas and Electric Company) Wastewater Discharge on Groundwater in the Tucson Basin,
W79-05519 5E

TUCSON GAS & ELECTRIC (AZ)
Evaluation of Proposed TG and E (Tucson Gas and Electric Company) Wastewater Discharge on Groundwater in the Tucson Basin,
W79-05519 5E

TURGIDITY
Water Relations of Cadmium-Treated Plants,
W79-05934 2I

TURKEY CREEK (TX)
Special Flood Hazard Information: Turkey Creek, Bryan, Texas.
W79-05716 2E

TUY RIVER BASIN (VENEZUELA)
Influence of Non-Point Pollution Sources in Connection with the Tuy River Basin Sanitation Studies,
W79-05740 5A

TWO DIMENSIONAL GASES
Research on Condensation Mechanisms,
W79-05882 3A

TWO-LAYER CIRCULATION MODELS
A Three-Dimensional Model of Lake Ontario's Summer Circulation, II. A Diagnostic Study,
W79-05635 2H

ULTIMATE DISPOSAL
Disposal of Saline Water Conversion Brines -- An Orientation Study,
W79-05657 3A

ULVA LACTUCA
Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

UNGAGED AREAS
Classification of Evaluation of Flood Flow Frequency Estimation Techniques,
W79-05844 2E

UNITED KINGDOM
The Occurrence of Organochlorine Residues in Rainwater,
W79-05848 5A

UNITED STATES
National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

Probable Maximum Precipitation Estimates, United States East of the 105th Meridian,
W79-05863 2B

UNSTEADY FLOW
A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

UPPER DUCK RIVER BASIN
Water Resources of the Upper Duck River Basin, Central Tennessee,
W79-05985 6D

URANIUM
National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

Groundwater Sampling in Uranium Reconnaissance,
W79-05521 5A

Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

URANIUM DEPOSITION
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

URANIUM RADIOISOTOPES
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

URBAN HYDROLOGY
Local Infiltration of Storm Water,
W79-05550 4A

Application of Hydraulic and Hydrologic Data in Urban Stormwater Management,
W79-05588 6A

URBAN LAKES
A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

URBAN RUNOFF
Some Results from Urban Runoff Studies in Bergsjon Goteborg,
W79-05548 2A

Some Aspects on Urban Runoff Quality Modeling,
W79-05549 5B

Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

URBAN STORMWATER MANAGEMENT
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

URBANIZATION
Swedish Urban Hydrological Research: A Review,
W79-05547 4C

Sediment Management Concepts in Urban Storm Water System Design,
W79-05981 4A

USSR
River Runoff Regulation and Water-Management Calculations, (Metodika Regulirovaniya Stoka i Vodokhozyaistvennykh Raschetov),
W79-05544 4A

UTAH
Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

VAPOR ADSORPTION
Development of the Direct Freeze Separation Process,
W79-05644 3A

VAPOR COMPRESSION DISTILLATION
Research on Forced-Circulation and Dropwise Condensation Techniques for Improving Heat Transfer Rates for Vapor Compression Evaporators,
W79-05646 3A

Vapor Compression with Secondary Heat-Transfer Media.
W79-05873 3A

VAPOR REHEAT
Research on Vapor Reheat and Liquid-Liquid Heat Exchange,
W79-05574 3A

VARIABILITY
Twentieth-Century Semi-Arid Climates and Climatic Fluctuations in Texas and Northeastern Mexico,
W79-05563 2A

Seasonal Cycling of Cesium-137 in a Reservoir
W79-05622 5E

VEGETATED SURFACE
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

EGETATION
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

EHICULAR POLLUTION
Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

ERMONT
Physical Measurement of Ice Jams, 1976-77 Field Season,
W79-05833 2C

IBRATIONS
An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

IRGINIA
Quantitative Analysis of Aircraft Multispectral-Scanner Data and Mapping of Water-Quality Parameters in the James River in Virginia,
W79-05862 7B

IRUSES
Adsorption of Virus on Activated Carbon Under Varying Water Chemistry Conditions,
W79-05831 5D

ADDEN SEA (NETHERLANDS)
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters,
W79-05718 5C

ARWICK AREA (NY)
Selected Low-Flow Characteristics of Streams in the Vicinity of Warwick, Orange County, New York,
W79-05595 2E

ASHINGTON
A Demonstration of Areawide Water Resources Planning--Users Manual,
W79-05715 6A

ASHINGTON DC METROPOLITAN AREA
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

ASTE DISPOSAL
Tough Environmental Requirements Demand New Approaches to Landfill,
W79-05505 5E

Sources of Urban Wastes,
W79-05689 5B

Contaminants Entering the New York Bight: Sources, Mass Loads, Significance,
W79-05690 5B

Trace Metals in the New York Bight,
W79-05691 5B

Oxygen Depletion in the New York Bight Apex: Causes and Consequences,
W79-05694 5B

Carbohydrates and Organic Carbon in New York Bight Sediments as Possible Indicators of Sewage Contamination,
W79-05695 5B

Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

Benthic-Pelagic Coupling in the New York Bight,
W79-05706 5C

Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

Safe Shellfish from the Sea,
W79-05713 5C

WASTE TREATMENT
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

WASTE WATER
Accomplishment Plan, Region VIII. Red River of the North Basin.
W79-05722 5G

Growth Effects of Major Land Use Projects (Wastewater Facilities), Volume I: Model Specification and Causal Analysis,
W79-05866 6G

WASTE WATER DISPOSAL
Evaluation of Proposed TG and E (Tucson Gas and Electric Company) Wastewater Discharge on Groundwater in the Tucson Basin,
W79-05519 5E

Sewage Osmosis System,
W79-05950 5D

WASTE WATER TREATMENT
Follum (Fabrikker A/S., Norway) has Fulfilled Antipollution Demands (Follum har oppfylt utslippskravene),
W79-05504 5D

Combined Effluents from Three Mills are Handled by Single New Facility,
W79-05507 5D

A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

Membrane Processes for Environmental Studies,
W79-05735 5D

Technology and Economics of Industrial Pollution Abatement,
W79-05865 5B

Removal of Color, Detergents, and Other Refractory Substances from Textile Wastewater,
W79-05867 5D

Water Treatment,
W79-05948 5D

Sewage Osmosis System,
W79-05950 5D

Method and Apparatus for Removing Filterable Substances from a Liquid,
W79-05955 5D

Removing Coagulable Substances from an Aqueous Medium,
W79-05956 5D

Process and Apparatus for Removal of Contaminants from Water,
W79-05957 5D

Sewage Treating and Conversion Process,
W79-05962 5D

Wastewater Treatment,
W79-05963 5D

WASTEWATER
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

WATER ALLOCATION (POLICY)
The Dark and Bloody Ground of Indian Water Rights: Confusion Elevated to Principle,
W79-05560 6E

WATER ANALYSIS
Installation of Water- and Gas-Sampling Wells in Low-Level Radioactive-Waste Burial Trenches, West Valley, New York,
W79-05970 5B

WATER BALANCE
Application of Ridge Regression Analysis to Water Resources Studies,
W79-05853 2A

WATER CHEMISTRY
National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

Groundwater Sampling in Uranium Reconnaissance,
W79-05521 5A

Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

Evaluation of the Rate of Decrease in the Iron Content of Water Pumped from a Flooded Shaft Mine in County, Durham, England,
W79-05933 2K

WATER CIRCULATION
Long Wave Model Independent of Stability Criteria,
W79-05534 2L

WATER CONSERVATION
Water Extraction from Black Liquors (Ekstraktsiya vody iz rastvorov chernogo shcheloka),
W79-05502 5D

WATER CONTRACTS
The Dark and Bloody Ground of Indian Water Rights: Confusion Elevated to Principle,
W79-05560 6E

WATER CONTROL
Hydrology and Water Control on Large Plains,
W79-05526 2A

Cam-Lock Water Gate,
W79-05951 8C

WATER COOLING
Assessment of a Cooling Lake Ecosystem,
W79-05964 2H

WATER COSTS
Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

WATER DELIVERY
A Note on the Economic Significance of Uniform Water Application,
W79-05816 3F

WATER DEMAND
Applications of Remote Sensing to Water Resources,
W79-05840 7B

WATER LEVEL FLUCTUATIONS
Selected Water-Level Records for Oklahoma, 1975-1977,
W79-05604 2F

WATER LEVELS
Hydrologic Data for Water-Table Aquifers in the Boulder--Fort Collins--Greeley Area, Front Range Urban Corridor, Colorado,
W79-05594 7C

Selected Water-Level Records for Oklahoma, 1975-1977,
W79-05604 2F

Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

Ground-Water Levels and Quality Data for Georgia, 1977,
W79-05607 4B

Ground-Water Data for 1976-77 in Joshua Tree National Monument, California,
W79-05982 2F

Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

WATER MANAGEMENT (APPLIED)
River Runoff Regulation and Water-Management Calculations, (Metodika Regulirovaniya Stoka i Vodokhozyaistvennykh Raschetov),
W79-05544 4A

Land and Water Use in Saudi Arabia,
W79-05561 5G

WATER POLLUTION
Patterns of Algal Succession in a Perturbated Marine Intertidal Community,
W79-05664 5C

Surficial Sediments of the NOAA-MESA Study Areas in the New York Bight,
W79-05685 5B

Spatial and Temporal Variation in Sedimentary Grain-Size Facies and Sediment Heavy Metal Ratios in the New York Bight Apex,
W79-05686 5C

Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

Accomplishment Plan, Region VIII. Red River of the North Basin.
W79-05722 5G

Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

Trace Metal Transport from Mining, Milling, and Smelting Watersheds,
W79-05858 5B

WATER POLLUTION CONTROL
Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

Membrane Processes for Environmental Studies,
W79-05735 5D

Standard Setting and the Theory of Institutional Choice: The Case of Pollution Control,
W79-05749 6C

An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

Economic Impact of Proposed Amendments to Water Pollution Regulations, R77-12, Docket A.
W79-05753 6E

WATER POLLUTION EFFECTS
Nonpoint Source Pollution,
W79-05582 5B

Patterns of Algal Succession in a Perturbated Marine Intertidal Community,
W79-05664 5C

Morbidity and Mortality of Marine Mammals,
W79-05668 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska,
W79-05675 5C

Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5B

Sources of Urban Wastes,
W79-05689 5B

Oxygen Depletion in the New York Bight Apex: Causes and Consequences,
W79-05694 5B

Effects of Coastal Pollution on Fish and Fisheries--With Particular Reference to the Middle Atlantic Bight,
W79-05699 5C

Some Results of Fish Surveys in the Mid-Atlantic Important For Assessing Environmental Impacts,
W79-05701 5C

Fin Rot Disease Studies in the New York Bight,
W79-05702 5C

Chromosome Mutagenesis in Developing Mackerel Eggs Sampled from the New York Bight,
W79-05703 5C

Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

Benthic-Pelagic Coupling in the New York Bight,
W79-05706 5C

Benthic Colonization Processes--A Review and a Proposed New Model,
W79-05707 5C

Distribution and Abundance of Inshore Populations of the Surf Clam Spisula Solidissima,
W79-05710 5C

Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

Safe Shellfish from the Sea,
W79-05713 5C

Health Hazards from Drinking-Water.
W79-05726 5A

Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

Shorebird Dependence on Arctic Littoral Habitats,
W79-05886 5C

Ecological Studies of Colonial Seabirds at Cape Thompson and Cape Lisburne, Alaska,
W79-05892 5C

Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

Community Structure of Seabirds of Wooded Island, Alaska,
W79-05900 5C

Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea,
W79-05916 5C

Bering Sea Ice Edge Ecosystem Study: Nutrient Cycling and Organic Matter Transfer,
W79-05917 5C

Effects of Oiling on Temperature Regulation in Sea Otters,
W79-05921 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

Composition and Source Identification of Organic Detritus in Lower Cook Inlet,
W79-05925 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Overview and Synthesis,
W79-05927 5C

Effects of Land Use and Water Management on Water Quality in the Western South New River Canal Basin, Southeast Florida, 1974-75,
W79-05978 4C

WATER POLLUTION SOURCES
Nonpoint Source Pollution,
W79-05582 5B

Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5B

Ocean-Atmosphere Interactions Off the Northeast Coast of North America,
W79-05681 5B

Sources of Urban Wastes,
W79-05689 5B

Contaminants Entering the New York Bight: Sources, Mass Loads, Significance,
W79-05690 5B

Trace Metals in the New York Bight,
W79-05691 5B

Oxygen Depletion in the New York Bight Apex: Causes and Consequences,
W79-05694 5B

Carbohydrates and Organic Carbon in New York Bight Sediments as Possible Indicators of Sewage Contamination,
W79-05695 5B

A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

Influence of Non-Point Pollution Sources in Connection with the Tuy River Basin Sanitation Studies,
W79-05740 5A

An Automatic Sequential Rain Sampler,
W79-05847 7B

The Occurrence of Organochlorine Residues in Rainwater,
W79-05848 5A

Wet and Dry Deposition of Nutrients in Central Alberta,
W79-05849 5B

Technology and Economics of Industrial Pollution Abatement,
W79-05865 5B

Chemical, Physical, Biochemical, and Bacteriological Characteristics at Selected Stream Sites in Puerto Rico, 1967-77,
W79-05967 7A

WATER POLLUTION TREATMENT

Technology and Economics of Industrial Pollution Abatement,
W79-05865 5B

Water Treatment,
W79-05948 5D

Method and Apparatus for Removing Filterable Substances from a Liquid,
W79-05955 5D

Removing Coagulable Substances from an Aqueous Medium,
W79-05956 5D

Apparatus for Removing Rainbows from Flowing Water,
W79-05961 5G

Sewage Treating and Conversion Process,
W79-05962 5D

Wastewater Treatment,
W79-05963 5D

WATER PROPERTIES

The Study of Ionic Solvation,
W79-05658 1A

New York Bight Water Stratification--October 1974,
W79-05682 1A

Distribution of Hydrographic Properties in the New York Bight Apex,
W79-05683 1A

WATER PURIFICATION

Process and Apparatus for Removal of Contaminants from Water,
W79-05957 5D

Seawater Distillation Apparatus,
W79-05958 3A

Apparatus for Removing Rainbows from Flowing Water,
W79-05961 5G

WATER QUALITY

Water Quality Improvements from Upgraded Waste Treatment,
W79-05503 5D

The Importance of Water Quality to Columbia River Salmon and Steelhead,
W79-05512 5C

Nitrates and Bacterial Distribution in Rural Domestic Water Supplies,
W79-05524 5B

Some Aspects on Urban Runoff Quality Modeling,
W79-05549 5B

Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

Summary of the Water Resources of Puerto Rico,
W79-05592 6D

Hydrologic Data for Water-Table Aquifers in the Boulder--Fort Collins--Greeley Area, Front Range Urban Corridor, Colorado,
W79-05594 7C

The Mississippi River Valley Alluvial Aquifer in Mississippi,
W79-05597 7C

Water Resources Data for Wyoming, Water Year 1977--Volume 1. Missouri River Basin,
W79-05598 7C

Water Resources Data for Wyoming, Water Year 1977--Volume 2. Green River Basin, Bear River Basin, Snake River Basin,
W79-05599 7C

Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

Ground-Water Levels and Quality Data for Georgia, 1977,
W79-05607 4B

Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

Water Resources of South-Central Iowa,
W79-05609 7C

Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

Accomplishment Plan, Region VIII. Red River of the North Basin.
W79-05722 5G

The Perception and Valuation of Water Quality: A Review of Research Method and Findings,
W79-05723 6B

Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

An Analysis of the Groundwater Resources of Tongatapu Island, Kingdom of Tonga,
W79-05827 2F

Quality of Selected Waters in Southern Maine.
W79-05832 5B

Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida,
W79-05839 5C

Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

Monitoring Areawide Rural Water Quality,
W79-05842 5A

Quantitative Analysis of Aircraft Multispectral-Scanner Data and Mapping of Water-Quality Parameters in the James River in Virginia,
W79-05862 7B

Chemical, Physical, Biochemical, and Bacteriological Characteristics at Selected Stream Sites in Puerto Rico, 1967-77,
W79-05967 7A

Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire,
W79-05968 7C

Modeling Nitrogen, Oxygen, Chattahoochee River, GA.,
W79-05974 5B

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

Effects of Land Use and Water Management on Water Quality in the Western South New River Canal Basin, Southeast Florida, 1974-75,
W79-05978 4C

Ground-Water Data for 1976-77 in Joshua Tree National Monument, California,
W79-05982 2F

Water Resources of the Upper Duck River Basin, Central Tennessee,
W79-05985 6D

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

Water Resources Data for Kansas, Water Year 1978,
W79-05989 7C

WATER QUALITY CONTROL
Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

Apparatus for Removing Rainbows from Flowing Water,
W79-05961 5G

WATER QUALITY MANAGEMENT (APPLIED)
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

WATER QUALITY STANDARDS
Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

Health Hazards from Drinking-Water.
W79-05726 5A

Standard Setting and the Theory of Institutional Choice: The Case of Pollution Control,
W79-05749 6C

An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

Economic Impact of Proposed Amendments to Water Pollution Regulations, R77-12, Docket A.
W79-05753 6E

WATER RESOURCES
Swedish Urban Hydrological Research: A Review,
W79-05547 4C

Summary of the Water Resources of Puerto Rico,
W79-05592 6D

The Perception and Valuation of Water Quality: A Review of Research Method and Findings,
W79-05723 6B

An Analysis of the Groundwater Resources of Tongatapu Island, Kingdom of Tonga,
W79-05827 2F

Applications of Remote Sensing to Water Resources,
W79-05840 7B

Application of Ridge Regression Analysis to Water Resources Studies,
W79-05853 2A

National Water Data Coordination in the United States,
W79-05971 7A

WATER RESOURCES DEVELOPMENT
Selected Priorities: 1978-82--A First-Year Effort Recommending Priorities for Selected Federal Water and Related Land Resource Programs in New England.
W79-05724 6E

Economics of Water Development in Less Developed Countries,
W79-05750 6B

WATER RESOURCES MANAGEMENT
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

A Demonstration of Areawide Water Resources Planning--Users Manual,
W79-05715 6A

WATER RESOURCES PLANNING
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

A Demonstration of Areawide Water Resources Planning--Users Manual,
W79-05715 6A

WATER REUSE
Potential for Using Saline Waste Water from Electrical Power Plants for Irrigation,
W79-05829 3C

WATER RIGHTS
The Dark and Bloody Ground of Indian Water Rights: Confusion Elevated to Principle,
W79-05560 6E

WATER RUNOFF
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

WATER SHORTAGE
Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6D

WATER STORAGE
The Founding of the Salt River Water Users Association,
W79-05555 6E

Stormwater Interception and Storage,
W79-05625 2E

Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6D

WATER STRUCTURE
The Study of Ionic Solvation,
W79-05658 1A

WATER SUPPLY
Synthesis and Calibration of a River Basin Water Management Model,
W79-05583 6B

Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

Potential Use of Converted Sea Water for Irrigation in Parts of California and Texas,
W79-05645 3A

Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

Water Resources of the Upper Duck River Basin, Central Tennessee,
W79-05985 6D

Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6D

WATER SUPPLY DEVELOPMENT
Preliminary Design of an Experimental Containerized Freeze Desalination Unit,
W79-05727 3A

WATER TABLE AQUIFERS
Hydrologic Data for Water-Table Aquifers in the Boulder--Fort Collins--Greeley Area, Front Range Urban Corridor, Colorado,
W79-05594 7C

WATER TEMPERATURE
Migrating Thermal Structure in a Freshwater Thermocline,
W79-05636 2H

An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

WATER TREATMENT
Influence of Non-Point Pollution Sources in Connection with the Tuy River Basin Sanitation Studies,
W79-05740 5A

Water Treatment,
W79-05948 5D

Process for Protecting Asbestos-Cement Bearing Surfaces in Recirculating Cooling Water Systems,
W79-05949 8F

Process and Apparatus for Removal of Contaminants from Water,
W79-05957 5D

Seawater Distillation Apparatus,
W79-05958 3A

WATER UTILIZATION
Effects of Water Management and Soil Physical Properties on Cotton Production in the Rolling Plains,
W79-05557 3F

Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

WATER VALUES
The Perception and Valuation of Water Quality: A Review of Research Method and Findings,
W79-05723 6B

WATER VAPOR
Computation of the Average Precipitation Over the Western Part of Peninsular India During the Summer Monsoon From the Continuity Equation for Atmospheric Water Vapour,
W79-05619 2B

WATER WELLS
Selected Water-Level Records for Oklahoma, 1975-1977,
W79-05604 2F

WATER YIELD
The Mississippi River Valley Alluvial Aquifer in Mississippi,
W79-05597 7C

Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

Ground-Water Data for 1976-77 in Joshua Tree National Monument, California,
W79-05982 2F

ATERSHED MANAGEMENT
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

ATERSHEDS (BASINS)
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

Walker Branch Watershed: Site Description and Research Scope,
W79-05837 2A

AVES (WATER)
Wave Forces on Cylinders Near Plane Boundaries,
W79-05532 2L

Long Wave Model Independent of Stability Criteria,
W79-05534 2L

Waves in Front of Long-Based Weirs,
W79-05540 8B

A Note on the Internal Solitary Waves Produced by Tidal Flow Over a Three-Dimensional Ridge,
W79-05631 2L

EATHER
Analysis of Cool Season Lake-Related Mesoscale Phenomena Using Numerical Variational Analysis,
W79-05523 2B

EATHER DATA
Twentieth-Century Semi-Arid Climates and Climatic Fluctuations in Texas and Northeastern Mexico,
W79-05563 2A

Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

EATHER MODIFICATION
Assessment of Weather Modification in Alleviating Agricultural Water Shortages During Droughts,
W79-05836 2B

EATHER PATTERNS
Dry Climates--Past and Present,
W79-05570 2A

Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

EIRS
Waves in Front of Long-Based Weirs,
W79-05540 8B

ELDING
Welding Still Widely Used in Drilling Industry,
W79-06000 8A

ELL DATA
Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

Hydrologic Data for Water-Table Aquifers in the Boulder--Fort Collins--Greeley Area, Front Range Urban Corridor, Colorado,
W79-05594 7C

Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

Ground-Water Data for 1976-77 in Joshua Tree National Monument, California,
W79-05982 2F

WEST VALLEY (NY)
Installation of Water- and Gas-Sampling Wells in Low-Level Radioactive-Waste Burial Trenches, West Valley, New York,
W79-05970 5B

WHEAT
The Effect of Supplemental Irrigation and Nitrogen Fertilization on Wheat (Triticum Aestivum L.),
W79-05817 2I

WILDLIFE
Evaluation of Planning for Fish and Wildlife, Lake Sharpe Reservoir Project,
W79-05717 6G

WILDLIFE MANAGEMENT
Evaluation of Planning for Fish and Wildlife, Lake Sharpe Reservoir Project,
W79-05717 6G

WIND EROSION
Predicting Sand Deposition at Porous Fences,
W79-05533 2J

Dust Storms and Their Geomorphological Implications,
W79-05559 2J

WINDS
Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

WINTERGREEN LAKE (MI)
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

WINTERS DOCTRINE
The Dark and Bloody Ground of Indian Water Rights: Confusion Elevated to Principle,
W79-05560 6E

WYOMING
Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

Water Resources Data for Wyoming, Water Year 1977--Volume 1. Missouri River Basin,
W79-05598 7C

Water Resources Data for Wyoming, Water Year 1977--Volume 2. Green River Basin, Bear River Basin, Snake River Basin,
W79-05599 7C

ZONATION
Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

ZOOPLANKTON
Mathematical Model and Computer Simulation of the Population Dynamics of Zooplankton in Lake and Estuary Ecosystems,
W79-05739 5C

Report on Zooplankton Community Grazing Experiments Conducted on Board the NOAA Ship, Discoverer, in the Bering Sea, May-June 1977,
W79-05918 5C

AUTHOR INDEX

AAMODT, P. L.
Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

ABBI, S. D. S.
A Statistical Study of the Annual Rainfall in the Sutlej Catchment and Annual Run-Off at Bhakra Dam Site,
W79-05628 2B

ADAMS, P. A.
Map Showing Drainage Areas, Collinsville Quadrangle, Connecticut,
W79-05603 7C

ADAMS, W. P.
Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

ADRIANO, D. C.
Growth and Elemental Composition of Corn and Bean Seedlings as Influenced by Soil Application of Coal Ash,
W79-05942 5B

AGENBROAD, L.
Surface and Groundwater Study of the White River, Osawes County, Nebraska,
W79-05801 2A

AINLEY, D. G.
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

AL-BADRI, A. S.
Tritium Dating of Some Groundwater Samples from Northwestern Iraqi Desert,
W79-05569 2F

ALBERTS, J. J.
Seasonal Cycling of Cesium-137 in a Reservoir,
W79-05622 5B

ALEVRAS, R. A.
Possibilities for Assessment of the Effects of Power Plant Operation at the Ecosystem Level,
W79-05780 5C

ALEXANDER, M.
Effects of SO2 and NO2 on Nitrification in Soil,
W79-05940 5B

ALEXANDER, V.
Bering Sea Ice Edge Ecosystem Study: Nutrient Cycling and Organic Matter Transfer,
W79-05917 5C

Bibliography on the Transfer of Synthesized Organic Matter to Zooplankton, Micronekton, and Ichthyoplankton,
W79-05919 5C

ALLEN, K. W.
Bibliography of Publications on Compounds of Gas Hydrate Type,
W79-05572 10C

ALLEY, W. M.
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

AMMERLAAN, A.
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

AMOS, A. F.
New York Bight Water Stratification--October 1974,
W79-05682 1A

ANDERSON, A. R.
Contaminants Entering the New York Bight: Sources, Mass Loads, Significance,
W79-05690 5B

ANDERSON, J. W.
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

ANDERSON, L. W. J.
Simazine Residue Levels in Irrigation Water After Ditchbank Application for Weed Control,
W79-05821 5B

ANDERSON, M. P.
Hydrogeology and Computer Model of the Bass Lake Area, St. Croix County, Wisconsin,
W79-05795 2H

ANDERSON, T. D.
Stream Chemistry and Watershed Nutrient Economy Following Wildfire and Fertilization in Eastern Washington,
W79-05824 5B

ARNELL, V.
Some Results from Urban Runoff Studies in Bergsjon Goteborg,
W79-05548 2A

ARNESON, P. D.
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska,
W79-05675 5C

ARSHAD ALI, S. M.
Performance of Center-Pivot Sprinkler Irrigation Systems Operating at Reduced Pressures,
W79-05997 3F

ASHTON, G. D.
River Ice,
W79-05860 2C

ASTROM, K. P. E.
Method and Apparatus for Removing Filterable Substances from a Liquid,
W79-05955 5D

ATLAS, R. M.
Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development on the Outer Continental Shelf of Alaska,
W79-05914 5C

ATMATZIDIS, D. K.
Granular Media Filtration of Dredging Effluents,
W79-05621 5A

ATWELL, J. S.
Sludge-Dewatering Techniques Must Meet Pollution Control Requirements,
W79-05506 5E

AUGENFELD, J. M.
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

AYRES, G. E.
Conservation and Conventional Systems for Continuous Production of Corn,
W79-05820 3F

BACA, R. G.
Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

BAHN, G. S.
Quantitative Analysis of Aircraft Multispectral-Scanner Data and Mapping of Water-Quality Parameters in the James River in Virginia,
W79-05862 7B

BAIRD, P. A.
The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

BAJOLLE, J. E.
Freezing Process Studies,
W79-05653 3A

BALBA, A.
An Outline of Soil, Water and Agriculture in Arab Countries,
W79-05553 2A

BARDUHN, A. J.
Freezing Process Studies,
W79-05653 3A

The Properties of Gas Hydrates and Their Use in Demineralizing Sea Water,
W79-05656 3A

BAREFOOT, A. D.
Performance of Center-Pivot Sprinkler Irrigation Systems Operating at Reduced Pressures,
W79-05997 3F

BARKER, S. L.
Mortalities of the Larvae of Two Species of Bivalves after Acute Exposure to Elevated Temperature,
W79-05771 5C

BARRY, R. G.
Dry Climates--Past and Present,
W79-05570 2A

BASON, W. H.
A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish,
W79-05788 8I

BAVADEKAR, S. N.
Computation of the Average Precipitation Over the Western Part of Peninsular India During the Summer Monsoon From the Continuity Equation for Atmospheric Water Vapour,
W79-05619 2B

BEARDSLEY, R. C.
Physical Oceanography of the Middle Atlantic Bight,
W79-05680 2J

BEAVEN, T. R.
Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

BECK, W. D.
A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

BECKMAN, R. J.
Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

BEITZ, B. E.
A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish,
W79-05788 8I

BEK, P.
A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

BENNETT, J. R.
A Three-Dimensional Model of Lake Ontario's Summer Circulation, II. A Diagnostic Study,
W79-05635 2H

BERBERIAN, G. A.
Oxygen Depletion in the New York Bight Apex: Causes and Consequences,
W79-05694 5B

BERG, M. E.
Investigation of Supersaturation in Saline Water Conversion,
W79-05872 3A

BERGEN, G.S.P.
The Role of the Scientist in the Section 316 Process: A Lawyer's Point of View,
W79-05758 5C

BERGENTHAL, J.
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

BERRY, D.
Water Treatment,
W79-05948 5D

BESCHTA, R. L.
The Suspended Sediment Regime of an Oregon Coast Range Stream,
W79-05846 2J

BETTANY, J. R.
Influence of the Chemical Form of Mercury on Its Adsorption and Ability to Leach Through Soils,
W79-05944 5B

The Uptake of 203Hg-Labeled Mercury Compounds by Bromegrass from Irrigated Undisturbed Soil Columns,
W79-05943 5B

BEUKEMA, J. J.
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters,
W79-05718 5C

BHATTACHARYA, M.
Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

BIDERMAN, J. O.
Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

Ecological Studies in the Northern Bering Sea: Studies of Seabirds in the Bering Strait,
W79-05891 5C

BIELORAI, H.
Grapefruit Response to Variable Salinity in Irrigation Water and Soil,
W79-05814 3C

BINNIE, A. M.
Waves in Front of Long-Based Weirs,
W79-05540 8B

BISCAYE, P. E.
Suspended Particulate Concentrations and Compositions in the New York Bight,
W79-05687 5C

BJORKLUND, L. J.
Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

BLACK, G. A.
Apparatus for Removing Rainbows from Flowing Water,
W79-05961 5G

BLISS, H.
Research on Forced-Circulation and Dropwise Condensation Techniques for Improving Heat Transfer Rates for Vapor Compression Evaporators,
W79-05646 3A

BLIVEN, L. F.
Monitoring Areawide Rural Water Quality,
W79-05842 5A

North Carolina 208 Case Study,
W79-05969 6E

BLOOMFIELD, J. J.
Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

BOCKRIS, J. O'M.
The Study of Ionic Solvation,
W79-05658 1A

BODEAU, D. J.
Statistical Comparison and Choices of Sampling Designs for Estimating Fish Impingement at Cooling Water Intakes,
W79-05776 5C

BOEKELHEIDE, R.
The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

BOERSMA, D.
Dynamics of Marine Bird Populations on the Barren Islands, Alaska,
W79-05899 5C

BOICOURT, W. C.
Physical Oceanography of the Middle Atlantic Bight,
W79-05680 2J

BOLTON, G. C.
Statistical Analysis of Concentration Records,
W79-05535 2J

BOTTCHER, A. B.
Subsurface Drainage Model with Associated Sediment Transport,
W79-05802 2J

BOUCK, G. R.
The Importance of Water Quality to Columbia River Salmon and Steelhead,
W79-05512 5C

BOWLES, R. R.
Evaluation of Ichthyoplankton Sampling Gear Used in Power Plant Entrainment Studies,
W79-05759 5C

BOWMAN, M. J.
Distribution of Hydrographic Properties in the New York Bight Apex,
W79-05683 1A

BOYD, C. E.
Predicting Nighttime Oxygen Depletion in Catfish Ponds,
W79-05800 2H

BOYD, E. L.
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

BRAHAM, H.
Baseline Characterization of Marine Mammals in the Bering Sea: Distribution and Abundance,
W79-05665 5C

BRAHAM, H. W.
Seasonal Distribution and Abundance of Bowhead and Beluga Whales in the Bering Sea and Arctic Ocean,
W79-05667 5C

Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska,
W79-05666 5C

BRANDSTETTER, A.
Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

BRESLER, E.
Analysis of Trickle Irrigation with Application to Design Problems,
W79-05815 3F

BRITTON, L. J.
Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

ROAD, A. C.
Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

ROADBENT, F. E.
Timing and Rate of Fertilizer Nitrogen for Sugarbeets Related to Nitrogen Uptake and Pollution Potential,
W79-05939 5B

ROCKWAY, C. E.
Rapidly Obtaining Optimal Irrigation System Designs,
W79-05993 3F

ROERSMA, K.
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

BROOKS, D.
Nitrates and Bacterial Distribution in Rural Domestic Water Supplies,
W79-05524 5B

BROWN, A. J.
The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

BROWNE, D. W.
Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

BROWNING, K. A.
Persistence and Orographic Modulation of Mesoscale Precipitation Areas in a Potentially Unstable Warm Sector,
W79-05855 2B

BRUNO, R. O.
Longshore Transport at a Total Littoral Barrier,
W79-05838 2H

BUCKEL, W. L.
A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

BUGBEE, S. L.
Implementation of Section 316 of the Federal Water Pollution Control Act,
W79-05755 5C

BURCHETT, C. R.
Water Resources of the Upper Duck River Basin, Central Tennessee,
W79-05985 6D

BURKE, W. J.
Comparison of 2.8- and 21-Cm Microwave Radiometer Observations over Soils with Emission Model Calculations,
W79-05633 7B

BURNS, J. J.
The Natural History and Ecology of the Bearded Seal (Erignathus Barbatus) and the Ringed Seal (Phoca Hispida),
W79-05670 5C

Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

BURNS, R. C.
Development of the Direct Freeze Separation Process,
W79-05644 3A

BUSCH, J. R.
Rapidly Obtaining Optimal Irrigation System Designs,
W79-05993 3F

BUSH, D. S.
Precipitation and Throughfall Chemistry in the San Francisco Bay Area,
W79-05937 5B

BUTLER, D. R.
Dew and Thermal Lag: A Model for Cocoa Pods,
W79-05856 2B

BUTZ, T. R.
Groundwater Sampling in Uranium Reconnaissance,
W79-05521 5A

CABELLI, V. J.
The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

CABIBBO, S. V.
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

CAGLE, J. W.
Water Resources of South-Central Iowa,
W79-05609 7C

CAIAZZA, R.
Wet and Dry Deposition of Nutrients in Central Alberta,
W79-05849 5B

CALKINS, D.
Biology of the Harbor Seal, Phoca Vitulina Richardi, in the Gulf of Alaska,
W79-05669 5C

Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

CALLAWAY, R. J.
Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

CALLIES, R. E.
'Corner Pivot' An Effective Corner Watering System,
W79-05990 3F

CALVIN, N. I.
Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

CAMERON, D. R.
Nitrogen Inputs and Losses in Tobacco, Bean, and Potato Fields in a Sandy Loam Watershed,
W79-05819 5B

CAMPBELL, W. J.
Flight Path Curvature Distortion in Side-Looking Airborne Radar Imagery,
W79-05973 7B

CANNON, T.
An Approach for the Analysis of Striped Bass Entrainment Survival at Hudson River Power Plants,
W79-05782 5C

CANNON, T. C.
Survival of Entrained Ichthyoplankton and Macroinvertebrates at Hudson River Power Plants,
W79-05762 5C

CANTILLO, A. Y.
Trace Metals in the New York Bight,
W79-05691 5B

CARA, J.
An Automatic Sequential Rain Sampler,
W79-05847 7B

CARACCIOLO, J. V.
Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

CAREY, A. G. JR.
The Distribution, Abundance, Diversity and Productivity of the Western Beaufort Sea Benthos,
W79-05906 5C

CARLSON, C. G.
Analysis and Dissemination of Water Resources Information,
W79-05792 7C

CARLSSON, L.
Estimation of Transmissivity and Permeability in Swedish Bedrocks,
W79-05551 2F

Injection of Water Into Wells for Investigation of Limited Aquifer,
W79-05552 4B

Swedish Urban Hydrological Research: A Review,
W79-05547 4C

CARLSTEDT, A.
Estimation of Transmissivity and Permeability in Swedish Bedrocks,
W79-05551 2F

CARRIER, R.F.
Documentation of Data and Literature Relevant to the Assessment of Thermal Power Plant Cooling System Effects on Aquatic Environments,
W79-05784 5C

CARTEE, R. L.
Potential for Using Saline Waste Water from Electrical Power Plants for Irrigation,
W79-05829 3C

CARTER, S. R.
Macroinvertebrate Entrainment Study at Fort Calhoun Station,
W79-05768 5C

CEARLOCK, D. B.
The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

CECH, I.
Nitrates and Bacterial Distribution in Rural Domestic Water Supplies,
W79-05524 5B

CEDERWALL, K.
Local Infiltration of Storm Water,
W79-05550 4A

CHADWICK, H. K.
Fisheries Issues Related to Water Development in the Sacramento-San Joaquin Estuary, California,
W79-05789 6G

CHANG, A. T. C.
Estimation of Snow Temperature and Mean Crystal Radius From Remote Multispectral Passive Microwave Measurements,
W79-05518 2C

CHANG, C.
Nitrogen Inputs and Losses in Tobacco, Bean, and Potato Fields in a Sandy Loam Watershed,
W79-05819 5B

CHARLES, K. E.
A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish,
W79-05788 8I

CHESTANG, B. G.
Process for Protecting Asbestos-Cement Bearing Surfaces in Recirculating Cooling Water Systems,
W79-05949 8F

CHEZAR, B.
Multifarious Power Plant Water Intake Structure: A Design to Reduce Impingement and Entrainment Mortality,
W79-05786 8I

CIBULKA, J. J.
Water Quality Improvements from Upgraded Waste Treatment,
W79-05503 5D

CIECKA, J. E.
An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

CIRAVOLO, T. G.
Growth and Elemental Composition of Corn and Bean Seedlings as Influenced by Soil Application of Coal Ash,
W79-05942 5B

CLAFLIN, L.
An Approach for the Analysis of Striped Bass Entrainment Survival at Hudson River Power Plants,
W79-05782 5C

CLARK, L. E.
Effects of Water Management and Soil Physical Properties on Cotton Production in the Rolling Plains,
W79-05557 3F

CLEMENTS, L. C.
Effects of Acute Thermal Stress on Marine Fish Embryos and Larvae,
W79-05769 5C

CLIFFORD, C. H.
Benthic-Pelagic Coupling in the New York Bight,
W79-05706 5C

COK, A. E.
Surficial Sediments of the NOAA-MESA Study Areas in the New York Bight,
W79-05685 5B

COLLINS, D. L.
A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

COLTON, J. S.
A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

COLWELL, R. R.
Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

COMMERFORD, G.
An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

CONNORS, P. G.
Shorebird Dependence on Arctic Littoral Habitats,
W79-05886 5C

CONRAD, B. F.
Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

COOLBROTH, F. P.
Sewage Osmosis System,
W79-05950 5D

COONEY, R. T.
Bering Sea Ice Edge Ecosystem Study: Nutrient Cycling and Organic Matter Transfer,
W79-05917 5C

Bibliography on the Transfer of Synthesized Organic Matter to Zooplankton, Micronekton, and Ichthyoplankton,
W79-05919 5C

CORNELIUS, G.
Drive Means for Irrigation System,
W79-05954 3F

COSTA, D. P.
Effects of Oiling on Temperature Regulation in Sea Otters,
W79-05921 5C

COTTON, J. E.
Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire,
W79-05968 7C

COUGHLIN, R. E.
The Perception and Valuation of Water Quality: A Review of Research Method and Findings,
W79-05723 6B

COX, E. F.
Research on Thermoelectric Heat Pumps,
W79-05875 3A

CRAIG, P. C.
Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Ecology of Fishes in Simpson Lagoon, 1977,
W79-05929 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

CRECELIUS, E. A.
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

CREWS, R. C.
Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida,
W79-05839 5C

CRIPPEN, R. W.
Impacts of Three Types of Power Generating Discharge Systems on Entrained Plankton,
W79-05770 5C

CULLEN, P.
A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

CUNNINGHAM, R. D.
Growth Effects of Major Land Use Projects (Wastewater Facilities), Volume I: Model Specification and Causal Analysis,
W79-05866 6G

CURRAN, J. C.
Regional Mean Bowen Ratios Deduced from Diurnal Changes of Temperature and Humidity,
W79-05883 2A

D'AGOSTINO, R. B.
Growth Effects of Major Land Use Projects (Wastewater Facilities), Volume I: Model Specification and Causal Analysis,
W79-05866 6G

DALSIN, G. J.
The Mississippi River Valley Alluvial Aquifer in Mississippi,
W79-05597 7C

DANKESE, J. P.
Design, Construction, Field Testing and Cost Analysis of an Experimental Electrodialysis Demineralizer for Brackish Waters,
W79-05651 3A

DAS, K. C.
Water Quality Improvements from Upgraded Waste Treatment,
W79-05503 5D

DAVIES, R. I.
Electron Probe Microanalytical Studies of Phosphorus Distribution Within Soil Fabric,
W79-05809 2G

DAVIS, R. E.
Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

DAVISON, R.
Development of the Solvent Demineralization of Saline Water,
W79-05650 3A

Research on Liquid-Liquid Extraction for Saline Water Conversion,
W79-05654 3A

DE BRUIN, W.
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters,
W79-05718 5C

DE DATTA, S. K.
Ammonia Volatilization Losses from Flooded Rice Soils,
W79-05812 2K

DE PUTTER, W. J.
Removing Coagulable Substances from an Aqueous Medium,
W79-05956 5D

DEGANGE, A.
Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

DEGANGE, A. R.
Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

DEHAN, K.
Salt Tolerance in the Wild Relatives of the Cultivated Tomato: Responses of Solanum Pennellii to High Salinity,
W79-05813 2I

DEJONG, R.
Nitrogen Inputs and Losses in Tobacco, Bean, and Potato Fields in a Sandy Loam Watershed,
W79-05819 5B

ROUEN, R. P.
Cam-Lock Water Gate,
W79-05951 8C

SERPA, A. C.
Congestion, Pollution, and Impure Public Goods,
W79-05748 6C

YAK, T. A.
The Effect of Water Pollution Control Regulations on the Cost of Production of Electric Power,
W79-05796 6B

TORO, D. M.
Stormwater Interception and Storage,
W79-05625 2E

ETERICH, R. A.
Morbidity and Mortality of Marine Mammals,
W79-05668 5C

ETERT, R.
An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

STSWORTH, G. R.
Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

VOKY, G. J.
The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. I: Breeding Bird Use of Barrier Islands in the Northern Chukchi and Beaufort Seas,
W79-05676 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. II: Feeding Habits of Birds in the Beaufort Sea,
W79-05677 5C

OWNING, D. J.
Ground-Water Data for 1976-77 in Joshua Tree National Monument, California,
W79-05982 2F

OWNING, R. A.
The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

RURY, W. H.
Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

Ecological Studies in the Northern Bering Sea: Studies of Seabirds in the Bering Strait,
W79-05891 5C

UBE, S. K.
A Statistical Study of the Annual Rainfall in the Sutlej Catchment and Annual Run-Off at Bhakra Dam Site,
W79-05628 2B

UEDALL, I. W.
Raritan Bay as a Source of Ammonium and Chlorophyll A for the New York Bight Apex,
W79-05693 5B

DUFOUR, A. P.
The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

DUNN, B.
Dye-Dispersion Study at Proposed Pumped-Storage Project on Hudson River at Cornwall-on-the-Hudson, New York,
W79-05596 5B

DUXBURY, J. M.
Nitrogen and Phosphorus Losses from Organic Soils,
W79-05823 5B

DYER, S. A.
Design of a Reliable, Inexpensive Recording Rain Gage Which Utilizes Solid-State Memory,
W79-05793 7B

EBEL, W. J.
Major Passage Problems,
W79-05509 5C

EDWARDS, R. L.
Middle Atlantic Fisheries: Recent Changes in Populations and Outlook,
W79-05700 5C

EGLINTON, G.
The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

EIBLING, J. A.
A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

EISELE, P. J.
A Conceptual Model of Causal Factors Regarding Gizzard Shad Runs at Steam Electric Power Plants,
W79-05778 5C

EISSLER, B. B.
Selected Low-Flow Characteristics of Streams in the Vicinity of Warwick, Orange County, New York,
W79-05595 2E

ELDER, J. A.
A Conceptual Representation of the New York Bight Ecosystem,
W79-05696 5B

ELEY, T. J.
The Natural History and Ecology of the Bearded Seal (Erignathus Barbatus) and the Ringed Seal (Phoca Hispida),
W79-05670 5C

ELLEMAN, T. C.
Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

EMBREE, W. N.
Estuarine Research: An Annotated Bibliography of Selected Literature, With Emphasis on the Hudson River Estuary, New York and New Jersey,
W79-05593 2L

ENGLERT, T. L.
Models Useful for the Estimation of Equilibrium Population Reduction Due to Power Plant Cropping,
W79-05764 5C

ENGLISH, M. C.
Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

ENGLISH, T. S.
Lower Cook Inlet Meroplankton,
W79-05913 5C

ERB, R. A.
Producing Selectively Infrared-Reflecting Surfaces on Plastic Films for Solar Stills,
W79-05659 3A

ERBACH, D. C.
Conservation and Conventional Systems for Continuous Production of Corn,
W79-05820 3F

EVANS, C. A.
Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

EVANS, M. S.
Effects of the Donald C. Cook Nuclear Power Plant on Zooplankton of Southeastern Lake Michigan,
W79-05766 5C

FABIAN, R. G.
An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

FAHMY, F. K.
Impacts of Three Types of Power Generating Discharge Systems on Entrained Plankton,
W79-05770 5C

FALCONER, I. R.
Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

FALVEY, H. T.
Mean Air Concentration of Self-Aerated Flow,
W79-05537 8B

FANGMEIER, D. D.
Mathematical Models and Border Irrigation Design,
W79-05991 3F

FANNING, D. S.
Extractability of Cadmium, Copper, Nickel, and Zinc by Double Acid Versus DTPA and Plant Content at Excessive Soil Levels,
W79-05946 5B

FAY, F. H.
An Amendment to RU232 Trophic Relationships Among Ice Inhabiting Phocid Seals, and RU230 Natural History of Ringed and Bearded Seals,
W79-05672 5C

Morbidity and Mortality of Marine Mammals,
W79-05668 5C

FEAZEL, C. E.
Investigation of Chelation as a Means of Removing Ions from Sea Water,
W79-05868 3A

FEDER, H. M.
Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

FERGUSON, R. B.
National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream

FERGUSON, R. B.

Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

FERGUSON, R. L.
Distribution of Suspended Bacteria in the Newport River Estuary, North Carolina,
W79-05623 2L

FIEBER, C.
Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation,
W79-05885 5C

FINK, F. W.
Corrosion of Metals in Sea Water,
W79-05870 3A

FINLAYSON, B. J.
Mortality of Young Striped Bass Entrained at Two Power Plants in the Sacramento-San Joaquin Delta, California,
W79-05761 5C

FINN, R. M.
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

FINNEMORE, E. J.
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

FISH, E. B.
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

FITZPATRICK, J. A.
Granular Media Filtration of Dredging Effluents,
W79-05621 5A

FLEMING, W. G.
Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: I. Nitrate-Nitrogen and Chloride Distribution in Soil Profiles,
W79-05641 5B

Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: II. Nitrogen and Chloride Transport in Runoff,
W79-05642 5B

FLYNN, K. M.
A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

FOIL, J. L.
Trace Metal Transport from Mining, Milling, and Smelting Watersheds,
W79-05858 5B

FONTUGNE, D. J.
Freezing Process Studies,
W79-05653 3A

FORD, G.
Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation,
W79-05885 5C

FORSELL, D.
Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

FRANZ, D. R.
Distribution and Abundance of Inshore Populations of the Surf Clam Spisula Solidissima,
W79-05710 5C

FRASER, J.
Preliminary Design of an Experimental Containerized Freeze Desalination Unit,
W79-05727 3A

FREELAND, G. L.
Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

Surficial Sediments of the NOAA-MESA Study Areas in the New York Bight,
W79-05685 5B

FREILICH, D.
Membrane Processes for Environmental Studies,
W79-05735 5D

FRENCH, J. B. JR.
Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

FRIED, M.
Timing and Rate of Fertilizer Nitrogen for Sugarbeets Related to Nitrogen Uptake and Pollution Potential,
W79-05939 5B

FRIEDRICKS, D. R.
The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

FROST, K. J.
Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

FROST, R. C.
Evaluation of the Rate of Decrease in the Iron Content of Water Pumped from a Flooded Shaft Mine in County, Durham, England,
W79-05933 2K

FUKUYAMA, A. K.
The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

FULLER, P. A.
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

FULLERTON, R. S.
Development of the Direct Freeze Separation Process,
W79-05644 3A

GABLE, C. G.
Longshore Transport at a Total Littoral Barrier,
W79-05838 2H

GADD, P. E.
Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

GADE, H. G.
Melting of Ice in Sea Water: A Primitive Model with Application to the Antarctic Ice Shelf and Icebergs,
W79-05857 2C

GALINATO, G. D.
Rapidly Obtaining Optimal Irrigation System Designs,
W79-05993 3F

GALLUP, D.
Wet and Dry Deposition of Nutrients in Central Alberta,
W79-05849 5B

GANGOPADHYAYA, M.
Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

GASH, J. H. C.
An Analytical Model of Rainfall Interception by Forests,
W79-05854 2D

GASPERINO, A. F.
Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

GERARD, C. J.
Effects of Water Management and Soil Physical Properties on Cotton Production in the Rolling Plains,
W79-05557 3F

GERARD, R. D.
New York Bight Water Stratification--October 1974,
W79-05682 1A

GHARRETT, J. A.
Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

GHISELIN, J.
Perils of the Orderly Mind: Cost-Benefit Analysis and Other Logical Pitfalls,
W79-05751 6E

GILBERT, R. G.
Redox Potentials in a Cropped Potato Processing Waste Water Disposal Field with a Deep Water Table,
W79-05822 5E

GILL, M. A.
Translatory Characteristics of the Muskingum Method of Flood Routing,
W79-05941 [illegible]

GILL, R.
Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

GING, S. E.
Potential for Using Saline Waste Water from Electrical Power Plants for Irrigation,
W79-05829 3C

GINN, T. C.
A Mathematical Model of the Interactions of an Aquatic Ecosystem and a Thermal Power Station Cooling System,
W79-05781 5C

Survival of Planktonic Organisms Following Passage Through a Simulated Power Plant Condenser Tube,
W79-05763 5C

GINSBERG, G. C.
Regulatory Developments in Section 316(b),
W79-05757 5G

GLASSEN, R. C.
Detection of Heavy Metal Pollution in Estuarine Sediments,
W79-05850 5B

GOEMAAT, R. L.
Selected Water-Level Records for Oklahoma, 1975-1977,
W79-05604 2F

GOETZ, C. L.
Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

GOLD, H.
Water and Energy in the Western Coal Lands,
W79-05845 6D

GOLUB, H.
Acid Precipitation in the New York Metropolitan Area: Its Relationship to Meteorological Factors,
W79-05626 2K

GONZALES, V. F.
Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

GOOD, E.
The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

GOODMAN, A. S.
Multifarious Power Plant Water Intake Structure: A Design to Reduce Impingement and Entrainment Mortality,
W79-05786 8I

GOODYEAR, C. P.
Entrainment Impact Estimates Using the Equivalent Adult Approach,
W79-05516 5C

GORDON, A. L.
New York Bight Water Stratification--October 1974,
W79-05682 1A

GOUDIE, A.
Arid Geomorphology,
W79-05558 2J

GOUDIE, A. S.
Dust Storms and Their Geomorphological Implications,
W79-05559 2J

GOULD, P. J.
Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

GRAHAM, P. H.
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

A Demonstration of Areawide Water Resources Planning--Users Manual,
W79-05715 6A

GRANNEMANN, N. G.
Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6D

GRAU, C. R.
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

GRAVLEE, G. C. JR.
Dye-Dispersion Study at Proposed Pumped-Storage Project on Hudson River at Cornwall-on-the-Hudson, New York,
W79-05596 5B

GRAY, R. H.
Comparative Fish Impingement at Two Adjacent Water Intakes on the Mid-Columbia River,
W79-05775 5C

GRAYSON, T. H.
Analysis of Cool Season Lake-Related Mesoscale Phenomena Using Numerical Variational Analysis,
W79-05523 2B

GREEN, H. S.
Seawater Distillation Apparatus,
W79-05958 3A

GRIFFITH, J. S.
An Analysis of Factors Influencing the Impingement of Threadfin Shad at Power Plants in the Southeastern United States,
W79-05774 5C

Temporally Stratified Sampling Programs for Estimation of Fish Impingement,
W79-05777 5C

GRIFFITHS, R. P.
Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

GRIFFITHS, W.
Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Ecology of Fishes in Simpson Lagoon, 1977,
W79-05929 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

GRONLUND, W. D.
Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea,
W79-05916 5C

GROSS, M. G.
Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5B

Sources of Urban Wastes,
W79-05689 5B

GROSSLEIN, M. D.
Some Results of Fish Surveys in the Mid-Atlantic Important For Assessing Environmental Impacts,
W79-05701 5C

GRUGER, E. H. JR.
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

GUIFFRIDA, A.
Investigation of Supersaturation in Saline Water Conversion,
W79-05872 3A

GULDBERG, P. H.
Growth Effects of Major Land Use Projects (Wastewater Facilities), Volume I: Model Specification and Causal Analysis,
W79-05866 6G

GULLIFORD, J. B.
Surface Water Quality Associated with the Surface Mining of Iowa Coal,
W79-05834 5B

GURANDSRUD, K. J.
Follum (Fabrikker A/S., Norway) has Fulfilled Antipollution Demands (Follum har oppfylt utslippskravene),
W79-05504 5D

GUY, D. B.
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

GUY, H. P.
Sediment Management Concepts in Urban Storm Water System Design,
W79-05981 4A

HABERMANN, P. W.
The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

HACKNEY, P. A.
A Method for Determining Growth and Mortality Rates of Ichthyoplankton,
W79-05765 5C

HAGE, K. D.
Wet and Dry Deposition of Nutrients in Central Alberta,
W79-05849 5B

HAGEDORN, C.
Transport of Antibiotic-Resistant Escherichia Coli Through Western Oregon Hillslope Soils Under Conditions of Saturated Flow,
W79-05932 5B

HAHN, W. J.
Development of the Direct Freeze Separation Process,
W79-05644 3A

HALL, J. D.
A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity - Their Numbers and Seasonal Movements,
W79-05674 5C

HALL, R. L.
The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

HALSEY, M. B.
Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

HAMMOND, D. S.
Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

HAN, G.
Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

HANDEL, C.
Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

HANKS, R. J.
Potential for Using Saline Waste Water from Electrical Power Plants for Irrigation,
W79-05829 3C

HANNAFORD, J. F.
The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

HANNON, E. H.
Documentation of Data and Literature Relevant to the Assessment of Thermal Power Plant Cooling System Effects on Aquatic Environments,
W79-05784 5C

HANSEL, J. M. JR.
Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

HANSEN, D. V.
Physical Oceanography of the Middle Atlantic Bight,
W79-05680 2J

HANSON, B. N.
A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish,
W79-05788 8I

HANSON, J. L.
Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

HARDING, J.
Ocean-Atmosphere Interactions Off the Northeast Coast of North America,
W79-05681 5B

HARGRAVE, B. T.
Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

Seasonal Changes in Oxygen Uptake by Settled Particulate Matter and Sediments in a Marine Bay,
W79-05638 2L

HARMONY, R. C.
Casing Mounted Emitter,
W79-05953 3F

HARRIS, W. F.
Walker Branch Watershed: Site Description and Research Scope,
W79-05837 2A

HARRIS, W. H.
Spatial and Temporal Variation in Sedimentary Grain-Size Facies and Sediment Heavy Metal Ratios in the New York Bight Apex,
W79-05686 5C

HARRISON, C. S.
Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

HART, D. L. JR.
Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

HATCH, S.
Breeding and Population Ecology of Fulmars at Semidi Islands, Alaska, with Observations on the Reproduction of Sympatric Seabird Species,
W79-05895 5C

HATCH, S. A.
Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

HATCHER, P. G.
Carbohydrates and Organic Carbon in New York Bight Sediments as Possible Indicators of Sewage Contamination,
W79-05695 5B

HAVEN, K. F.
A Mathematical Model of the Interactions of an Aquatic Ecosystem and a Thermal Power Station Cooling System,
W79-05781 5C

HAWKINS, B. E.
Effects of the Donald C. Cook Nuclear Power Plant on Zooplankton of Southeastern Lake Michigan,
W79-05766 5C

HAWKINS, J. S.
Acid Precipitation in the New York Metropolitan Area: Its Relationship to Meteorological Factors,
W79-05626 2K

HAYTON, A. M.
Impacts of Three Types of Power Generating Discharge Systems on Entrained Plankton,
W79-05770 5C

HEALY, R. P.
Adsorption of Virus on Activated Carbon Under Varying Water Chemistry Conditions,
W79-05831 5D

HEATH, R. C.
Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

HEERMANN, D. F.
Determining Center-Pivot Sprinkler Uniformities,
W79-05996 3F

HEINEMANN, D.
Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation,
W79-05885 5C

HEINITZ, A. J.
Water Resources of South-Central Iowa,
W79-05609 7C

HELVEY, J. D.
Stream Chemistry and Watershed Nutrient Economy Following Wildfire and Fertilization in Eastern Washington,
W79-05824 5B

HETTLER, W. F.
Effects of Acute Thermal Stress on Marine Fish Embryos and Larvae,
W79-05769 5C

HIGHSMITH, R. M.
Center Pivot Irrigation in the Columbia Basin of Washington and Oregon: Dynamics and Implications,
W79-05818 3F

HILL, F. F.
Persistence and Orographic Modulation of Mesoscale Precipitation Areas in a Potentially Unstable Warm Sector,
W79-05855 2B

HILLEGAS, J. M. JR.
Possibilities for Assessment of the Effects of Power Plant Operation at the Ecosystem Level,
W79-05780 5C

HILLIER, D. E.
Hydrologic Data for Water-Table Aquifers in the Boulder--Fort Collins--Greeley Area, Front Range Urban Corridor, Colorado,
W79-05594 7C

HILLS, F. J.
Timing and Rate of Fertilizer Nitrogen for Sugarbeets Related to Nitrogen Uptake and Pollution Potential,
W79-05939 5B

HILSINGER, J.
Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

HINCKLEY, S.
Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

HINKLEY, T.
Concentrations of Metals in Very Small Volumes of Soil Solution,
W79-05976 7B

HIRONAKA, V. F.
The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

HIRSCH, K.
The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

HOBERG, E.
The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

HOBERG, M.
Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

HOBERT, M.
Distribution, Abundance, Community Structure and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

HODGINS, H. O.
Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea,
W79-05916 5C

Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformation as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices
W79-05922 5C

HOFMANN, P.
Engineering Implications of New Fish Screening Concepts,
W79-05785

HOGG, T. J.
Influence of the Chemical Form of Mercury on Its Adsorption and Ability to Leach Through Soils,
W79-05944 5

The Uptake of 203Hg-Labeled Mercury Compounds by Bromegrass from Irrigated Undisturbed Soil Columns,
W79-05943 5

HOLMSTRAND, O.
Local Infiltration of Storm Water,
W79-05550 4

HOOD, D. W.
Development of the Solvent Demineralization Saline Water,
W79-05650 3

Research on Liquid-Liquid Extraction for Saline Water Conversion,
W79-05654 3A

HOOVER, T. B.
Research on Salt Water Purification by Freezing,
W79-05881 3A

HORNER, R. A.
Beaufort Sea Plankton Studies,
W79-05912 5C

HORNEY, L. F.
North Carolina 208 Case Study,
W79-05969 6E

HORTON, M. L.
Analysis and Dissemination of Water Resources Information,
W79-05792 7C

HOSSNER, L. R.
Cation Exchange Equilibria in a Mixed Soil System Containing Three Heterovalent Cations,
W79-05808 2G

HU, Y-C.
The Properties of Gas Hydrates and Their Use in Demineralizing Sea Water,
W79-05656 3A

HUBER, H.
The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

HUFF, F. A.
Assessment of Weather Modification in Alleviating Agricultural Water Shortages During Droughts,
W79-05836 2B

HUFFMAN, S. F.
Hydrogeology and Computer Model of the Bass Lake Area, St. Croix County, Wisconsin,
W79-05795 2H

HUGGINS, L. F.
Subsurface Drainage Model with Associated Sediment Transport,
W79-05802 2J

HUGGINS, T. G.
Impingement Survival Studies on White Perch, Striped Bass, and Atlantic Tomcod at Three Hudson River Power Plants,
W79-05772 5C

HULL, J. E.
Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

HUMENIK, F. J.
Monitoring Areawide Rural Water Quality,
W79-05842 5A

North Carolina 208 Case Study,
W79-05969 6E

HUNDLEY, N. JR.
The Dark and Bloody Ground of Indian Water Rights: Confusion Elevated to Principle,
W79-05560 6E

HUNT, B.
An Analysis of the Groundwater Resources of Tongatapu Island, Kingdom of Tonga,
W79-05827 2F

HUNT, G. L. JR.
Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5C

HUNTER, J. V.
Sources and Fates of Aromatic Compounds in Urban Stormwater Runoff,
W79-05627 5A

HUNTZINGER, T. L.
Application of Hydraulic and Hydrologic Data in Urban Stormwater Management,
W79-05588 6A

HURTADO, J. R.
Influence of Non-Point Pollution Sources in Connection with the Tuy River Basin Sanitation Studies,
W79-05740 5A

HUSSAIN, Z.
Land and Water Use in Saudi Arabia,
W79-05561 5G

HUTCHISON JR, J. B.
Impingement Survival Studies on White Perch, Striped Bass, and Atlantic Tomcod at Three Hudson River Power Plants,
W79-05772 5C

IRWIN, J. R.
A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

ISBELL, A. F.
Development of the Solvent Demineralization of Saline Water,
W79-05650 3A

JACKSON, A. R. B.
Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

JACKSON, F. L.
Producing Selectively Infrared-Reflecting Surfaces on Plastic Films for Solar Stills,
W79-05659 3A

JACKSON, W. A.
Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: I. Nitrate-Nitrogen and Chloride Distribution in Soil Profiles,
W79-05641 5B

Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: II. Nitrogen and Chloride Transport in Runoff,
W79-05642 5B

JAHN, A.
Problems of the Periglacial Zone (Zagadnienia Strefy Peryglacjalnej),
W79-05545 2C

JAMES, L. D.
Economics of Water Development in Less Developed Countries,
W79-05750 6B

JANSEN, J. J. M.
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters,
W79-05718 5C

JARRETT, A. R.
Computer Model for Center Pivot Sprinkler Design,
W79-05994 3F

JEFFREY, L. M.
Research on Liquid-Liquid Extraction for Saline Water Conversion,
W79-05654 3A

JENKINS, D. A.
Electron Probe Microanalysis of Calcite Grains Containing Phosphorus in Soil,
W79-05810 2G

Electron Probe Microanalytical Studies of Phosphorus Distribution Within Soil Fabric,
W79-05809 2G

JENNETT, J. C.
Trace Metal Transport from Mining, Milling, and Smelting Watersheds,
W79-05858 5B

JENNINGS, M. E.
Modeling Nitrogen, Oxygen, Chattahoochee River, GA.,
W79-05974 5B

JERIS, J. S.
Contaminants Entering the New York Bight: Sources, Mass Loads, Significance,
W79-05690 5B

JEWETT, J. E.
A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

JEWETT, S.
Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

JINKS, S. M.
An Approach for the Analysis of Striped Bass Entrainment Survival at Hudson River Power Plants,
W79-05782 5C

Survival of Entrained Ichthyoplankton and Macroinvertebrates at Hudson River Power Plants,
W79-05762 5C

JOHANSSON, J. C.
Method and Apparatus for Removing Filterable Substances from a Liquid,
W79-05955 5D

JOHNS, B.
The Modeling of Tidal Flow in a Channel Using a Turbulence Energy Closure Scheme,
W79-05637 2L

JOHNSON, A. I.
National Water Data Coordination in the United States,
W79-05971 7A

JOHNSON, C. J.
Disposal of a Large Quantity of Sodium Fluoroacetate in a Sanitary Landfill Site Located in an Aquifer Recharging Area,
W79-05835 5G

JOHNSON, D.
Determination of Optimal Well Capacities for Continuous Irrigation Programs,
W79-05825 3F

JOHNSON, J. H.
A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity - Their Numbers and Seasonal Movements,
W79-05674 5C

JOHNSON, R. L.
Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

JOHNSON, R. M.
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

JOHNSON, R. W.
Quantitative Analysis of Aircraft Multispectral-Scanner Data and Mapping of Water-Quality Parameters in the James River in Virginia,
W79-05862 7B

JOHNSON, S. R.
Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Avian Ecology in Simpson Lagoon, 1977,
W79-05928 5C

JOHNSTONE, S. J.
The Occurrence of Organochlorine Residues in Rainwater,
W79-05848 5A

JORDAN, J. B.
An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

JOYCE, A. T.
Proceedings for Gathering Ground Truth Information for a Supervised Approach to a Computer-Implemented Land Cover Classification of Landsat-Acquired Multispectral Scanner Data,
W79-05859 7B

KAFKAFI, U.
The Effect of Supplemental Irrigation and Nitrogen Fertilization on Wheat (Triticum Aestivum L.),
W79-05817 2I

KAKA, G. F.
Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

KALMAZ, E. V.
Mathematical Model and Computer Simulation of the Population Dynamics of Zooplankton in Lake and Estuary Ecosystems,
W79-05739 5C

KAMLER, E.
Ecological Bioenergetics of Physa Acuta (Gastropoda) in Heated Waters,
W79-05514 5C

KAPINOS, F. P.
National Water Data Coordination in the United States,
W79-05971 7A

KARRICK, N.
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

KATZ, B. G.
Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

KAWAZOE, K.
Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

KEELY, R. H.
Sprinkler Nozzle,
W79-05952 3F

KEILEN, B.
The Mechanism of Desalination by Reverse Osmosis,
W79-05878 3A

KEISTER, L. E.
Carbohydrates and Organic Carbon in New York Bight Sediments as Possible Indicators of Sewage Contamination,
W79-05695 5B

KELLY, B. P.
Morbidity and Mortality of Marine Mammals,
W79-05668 5C

KELSO, G. L.
Computer Model for Center Pivot Sprinkler Design,
W79-05994 3F

KESSLER, S. J.
Major Chemical Constituents of Arizona Lakes,
W79-05567 2H

KEY, T. H.
Preliminary Studies on the Operating Aspects of Small Slot Width Wedgewire Screens with Conceptual Designs for Power Station Use,
W79-05787 8I

KILAR, J. A.
Ecological Studies of the Annual Red Alga Dumontia Ncrassata (O.F. Muller) Lamouroux,
W79-05618 5C

KIMOR, B.
An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

KING, L. R.
Impingement Survival Studies on White Perch, Striped Bass, and Atlantic Tomcod at Three Hudson River Power Plants,
W79-05772 5C

Survival of Entrained Ichthyoplankton and Macroinvertebrates at Hudson River Power Plants,
W79-05762 5C

KING, R. G.
Entrainment of Missouri River Fish Larvae Through Fort Calhoun Station,
W79-05760 5C

KIPP, K. L.
The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

KIRKHAM, M. B.
Water Relations of Cadmium-Treated Plants,
W79-05934 2I

KIRKHAM, T. A.
Design, Construction, Field Testing and Cost Analysis of an Experimental Electrodialysis Demineralizer for Brackish Waters,
W79-05651 3A

KITCHELL, J. F.
Assessment of a Cooling Lake Ecosystem,
W79-05964 2H

KITCHELL, W. F.
Effect of Septic Tank Effluent on the Base Status of Two Tile-Drained Soils,
W79-05945 5B

KLEIN, E.
Study of Oriented Cellulose Membranes for Reverse Osmosis and the Relationship Between Morphology and Salt Rejection,
W79-05879 3A

KLEIN, H.
Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

KLING, G. F.
Transport of Antibiotic-Resistant Escherichia Coli Through Western Oregon Hillslope Soils Under Conditions of Saturated Flow,
W79-05932 5B

KNYAZ'KOVA, T. V.
Water Extraction from Black Liquors (Ekstraktsiya vody iz rastvorov chernogo shcheloka),
W79-05502 5D

KO, A.
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

KOCH, H.
Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

KODITSCHEK, L.
Antimicrobial Resistant Bacteria in the New York Bight,
W79-05708 5C

KOEHLER, F. A.
Monitoring Areawide Rural Water Quality,
W79-05842 5A

North Carolina 208 Case Study,
W79-05969 6E

KOENIG, L.
Disposal of Saline Water Conversion Brines - An Orientation Study,
W79-05657 3A

KOLBERG, D. F.
Tough Environmental Requirements Demand New Approaches to Landfill,
W79-05505 5E

KOOYMAN, G. L.
Effects of Oiling on Temperature Regulation i Sea Otters,
W79-05921 5C

KORCAK, R. F.
Extractability of Cadmium, Copper, Nickel, an Zinc by Double Acid Versus DTPA and Plan Content at Excessive Soil Levels,
W79-05946 5I

KOVACS, G.
Hydrology and Water Control on Large Plain
W79-05526 2

KOZAK, V. P.
Frequency and Extent of Wind-Induced Res spension of Bottom Material in the U.S. Gre Lakes Nearshore Waters,
W79-05736

KOZERSKI, B.
Injection of Water Into Wells for Investigati of Limited Aquifer,
W79-05552

KRENKEL, J. H.
The Founding of the Salt River Water Use Association,
W79-05555

RIZEK, R. J.
Granular Media Filtration of Dredging Effluents,
W79-05621 5A

ROGMAN, B. D.
Seasonal Distribution and Abundance of Bowhead and Beluga Whales in the Bering Sea and Arctic Ocean,
W79-05667 5C

ROUSE, C. A.
The Power Plant Regulatory Program: A Congressional Dilimma,
W79-05756 5C

ROUTIL, W. F.
Corn Yields from Irrigation with Adequate and Deficient Water,
W79-05803 3F

UEPPER, G.
Determination of Optimal Well Capacities for Continuous Irrigation Programs,
W79-05825 3F

UL'SKII, L. A.
Water Extraction from Black Liquors (Ekstraktsiya vody iz rastvorov chernogo shcheloka),
W79-05502 5D

UMAR, K. D.
An Analysis of Factors Influencing the Impingement of Threadfin Shad at Power Plants in the Southeastern United States,
W79-05774 5C

Temporally Stratified Sampling Programs for Estimation of Fish Impingement,
W79-05777 5C

URBIEL, J.
Removal of Color, Detergents, and Other Refractory Substances from Textile Wastewater,
W79-05867 5D

ABADIE, J. W.
Synthesis and Calibration of a River Basin Water Management Model,
W79-05583 6B

ABEDA, D.
Effects of SO2 and NO2 on Nitrification in Soil,
W79-05940 5B

ACEY, R. E.
Demineralization by Transport Depletion,
W79-05876 3A

Desalination by Electrosorption and Desorption,
W79-05575 3A

Investigation of Chelation as a Means of Removing Ions from Sea Water,
W79-05868 3A

AEVAST, T.
Ocean-Atmosphere Interactions Off the Northeast Coast of North America,
W79-05681 5B

AGER, J. A.
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

AL, R.
Concentration and Size of Gravel in Relation to Neutron Moisture and Density Probe Calibration,
W79-05530 7B

ANG, E. W.
Desalination by Electrosorption and Desorption,
W79-05575 3A

Investigation of Chelation as a Means of Removing Ions from Sea Water,
W79-05868 3A

LANGDALE, G. W.
Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: I. Nitrate-Nitrogen and Chloride Distribution in Soil Profiles,
W79-05641 5B

Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: II. Nitrogen and Chloride Transport in Runoff,
W79-05642 5B

LANGFORD, R. H.
National Water Data Coordination in the United States,
W79-05971 7A

LARRANCE, J. D.
Composition and Source Identification of Organic Detritus in Lower Cook Inlet,
W79-05925 5C

LARSON, C. L.
Effects of Drainage Projects on Runoff from Depressional Watersheds,
W79-05979 4A

LARSON, G. L.
Evaluation of Groundwater Flow and Recharge Through Glacial Drift, Michigan State Water Quality Management Project, East Lansing, Michigan,
W79-05791 4B

LARSON, S.
Ocean-Atmosphere Interactions Off the Northeast Coast of North America,
W79-05681 5B

LASENBY, D. C.
Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

LATIMER, D.
An Approach for the Analysis of Striped Bass Entrainment Survival at Hudson River Power Plants,
W79-05782 5C

LAUER, G.
An Approach for the Analysis of Striped Bass Entrainment Survival at Hudson River Power Plants,
W79-05782 5C

LAUER, G. J.
Survival of Entrained Ichthyoplankton and Macroinvertebrates at Hudson River Power Plants,
W79-05762 5C

LAUGHLIN, C. P.
Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

LAVELLE, J. W.
Effects of Hindered Settling on Sediment Concentration Profiles,
W79-05542 2J

Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

LAWLER, J. P.
Models Useful for the Estimation of Equilibrium Population Reduction Due to Power Plant Cropping,
W79-05764 5C

LAZIER, J.
Migrating Thermal Structure in a Freshwater Thermocline,
W79-05636 2H

LE HOUEROU, H. N.
Biological Recovery Versus Desertization,
W79-05556 3B

LEFSTAD, S. M.
Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida,
W79-05839 5C

LEHNHAUSEN, W.
Community Structure of Seabirds of Wooded Island, Alaska,
W79-05900 5C

LEMAN, B.
The Mid-Columbia Public Utility Responsibility,
W79-05511 5C

LENAU, C. W.
Supercritical Flow in Bends of Trapezoidal Section,
W79-05531 2E

LENSINK, C. J.
Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

LEONARD, R. A.
Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: I. Nitrate-Nitrogen and Chloride Distribution in Soil Profiles,
W79-05641 5B

Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: II. Nitrogen and Chloride Transport in Runoff,
W79-05642 5B

LEUNG, P-S.
A Print-Plot Display System for a Linear Programming-Based Resources Planning Model,
W79-05797 6A

LEVALLEY, R. R.
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

LEVIN, M. A.
The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

LEVY, Y.
Grapefruit Response to Variable Salinity in Irrigation Water and Soil,
W79-05814 3C

LIANG, T.
A Print-Plot Display System for a Linear Programming-Based Resources Planning Model,
W79-05797 6A

LIEDING, C. A.
Dual-Function Valve,
W79-05959 3F

LIFTON, W. S.
Effect of Environmental Variables on Fish Impingement,
W79-05779 5C

LINCHKOVSKAYA, N. A.
Water Extraction from Black Liquors (Ekstraktsiya vody iz rastvorov chernogo shcheloka),
W79-05502 5D

LINDNER, J. B.
Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

LING, C. H.
Flight Path Curvature Distortion in Side-Looking Airborne Radar Imagery,
W79-05973 7B

LINK, A. N.
The Effect of Water Pollution Control Regulations on the Cost of Production of Electric Power,
W79-05796 6B

LIOY, P. J.
Acid Precipitation in the New York Metropolitan Area: Its Relationship to Meteorological Factors,
W79-05626 2K

LITCHFIELD, C. D.
Bacterial Flux in Some New Jersey Estuarine Sediments,
W79-05704 2L

LITTLER, M. M.
Patterns of Algal Succession in a Perturbated Marine Intertidal Community,
W79-05664 5C

LOAR, J. M.
An Analysis of Factors Influencing the Impingement of Threadfin Shad at Power Plants in the Southeastern United States,
W79-05774 5C

LOGAN, D. T.
Possibilities for Assessment of the Effects of Power Plant Operation at the Ecosystem Level,
W79-05780 5C

LONGLEY, T. S.
Erosion Control/Sediment Modeling--Southern Idaho a Progress Report,
W79-05804 2J

LONGWELL, A. C.
Chromosome Mutagenesis in Developing Mackerel Eggs Sampled from the New York Bight,
W79-05703 5C

LOVATO, J.
Evaluation of Groundwater Flow and Recharge Through Glacial Drift, Michigan State Water Quality Management Project, East Lansing, Michigan,
W79-05791 4B

LOVELY, W. G.
Conservation and Conventional Systems for Continuous Production of Corn,
W79-05820 3F

LOWRY, L. F.
Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

LOZANO, S. J.
Assessment of a Cooling Lake Ecosystem,
W79-05964 2H

LURIE, R. M.
Investigation of Supersaturation in Saline Water Conversion,
W79-05872 3A

LYAPICHEV, P. A.
River Runoff Regulation and Water-Management Calculations, (Metodika Regulirovaniya Stoka i Vodokhozyaistvennykh Raschetov),
W79-05544 4A

LYNARD, W. G.
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

LYNGFELT, S.
Some Results from Urban Runoff Studies in Bergsjon Goteborg,
W79-05548 2A

MACKENZIE, M. J.
Sources and Fates of Aromatic Compounds in Urban Stormwater Runoff,
W79-05627 5A

MACKINNON, J. S.
Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

MADAN, G.
The Study of Ionic Solvation,
W79-05658 1A

MAHERAS, G.
Design, Construction, Field Testing and Cost Analysis of an Experimental Electrodialysis Demineralizer for Brackish Waters,
W79-05651 3A

MAINS, E. M.
Corps of Engineers Responsibilities and Actions to Maintain Columbia Basin Anadromous Fish Runs,
W79-05510 5C

MALARIC, J. F.
A Conceptual Model of Causal Factors Regarding Gizzard Shad Runs at Steam Electric Power Plants,
W79-05778 5C

MALHOTRA, S. P.
Traditional Perceptabilities (Sic.) of Environment and Desertification: A Case Study,
W79-05562 6B

MALINS, D. C.
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

MALONE, T. C.
Phytoplankton Productivity in the Apex of the New York Bight: Environmental Regulation of Productivity/Chlorophyll A,
W79-05697 5B

MANDECKI, W.
Ecological Bioenergetics of Physa Acuta (Gastropoda) in Heated Waters,
W79-05514 5C

MANNING, R. E.
Impacts of Recreation on Riparian Soils and Vegetation,
W79-05843 4C

MANUWAL, D. A.
Dynamics of Marine Bird Populations on the Barren Islands, Alaska,
W79-05899 5C

MARGILOFF, I. B.
A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

MARINOS, A. T.
Flow Profiles in Trapezoidal Channels by Pocket Calculators,
W79-05538 8B

MARMORINO, G. O.
Inertial Currents in Lake Ontario, Winter 1972-73 (IFYGL),
W79-05634 2H

MARSHALL, N.
Cultivating and Harvesting Algae to Forestall Accelerated Eutrophication,
W79-05584 5C

MARTIN, S.
Combined Effluents from Three Mills are Handled by Single New Facility,
W79-05507 5D

MASARIK, D.
Zinc and Cadmium Contents of Agricultural Soils and Corn in Northwestern Indiana,
W79-05947 5B

MASON, D. T.
Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

MASON, H.
Freezing Process Studies,
W79-05653 3A

MATHEKE, G.
Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

MATHIESON, A. C.
Ecological Studies of the Annual Red Alga Dumontia Nerassata (O.F. Muller) Lamouroux,
W79-05618 5C

MATTHEWS, R. R.
Theoretical Studies of the Behavior of Ions in Aqueous Solutions of Mixed Electrolytes with Respect to Osmionic Operation,
W79-05647 3A

MATTRAW, H. C.
Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

MAXWORTHY, T.
A Note on the Internal Solitary Waves Produced by Tidal Flow Over a Three-Dimensional Ridge,
W79-05631 2E

MAYER, B.
Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5

MCCAIN, B. B.
Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea,
W79-05916 5

MCCOLL, J. G.
Precipitation and Throughfall Chemistry in the San Francisco Bay Area,
W79-05937 5

MCCOY, E. L.
Transport of Antibiotic-Resistant Escherichia Coli Through Western Oregon Hillslope Soil Under Conditions of Saturated Flow,
W79-05932 5

MCCOY, H. J.
Summary of the Water Resources of Puerto Rico,
W79-05592 6

MCCUEN, R. H.
Classification of Evaluation of Flood Flow Frequency Estimation Techniques,
W79-05844 2E

MCDANNALD, R. B.
The Care of Explosives,
W79-05998 8H

MCDONALD, J.
Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

MCFEE, W. W.
Zinc and Cadmium Contents of Agricultural Soils and Corn in Northwestern Indiana,
W79-05947 5B

MCLAUGHLIN, D. B.
A Conceptual Representation of the New York Bight Ecosystem,
W79-05696 5B

MCNEIL, P.
Potential for Using Saline Waste Water from Electrical Power Plants for Irrigation,
W79-05829 3C

MCPHERSON, B. F.
Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

MELVIN, R. L.
Map Showing Drainage Areas, New Britain Quadrangle, Connecticut,
W79-05602 7C

MERCER, R. W.
Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska,
W79-05666 5C

MERILATT, D. S.
An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

MERRIAM, J. L.
Border-Strip Irrigation Design--Practical Approach from a Theoretical Basis,
W79-05992 3F

MERRINER, J. V.
Evaluation of Ichthyoplankton Sampling Gear Used in Power Plant Entrainment Studies,
W79-05759 5C

MEYER, F. W.
Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

MICKELSON, P. G.
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-05890 5C

Community Structure of Seabirds of Wooded Island, Alaska,
W79-05900 5C

MIJARES, G. R.
Influence of Non-Point Pollution Sources in Connection with the Tuy River Basin Sanitation Studies,
W79-05740 5A

MIKKELSEN, D. S.
Ammonia Volatilization Losses from Flooded Rice Soils,
W79-05812 2K

MILBURN, G. S.
Regulatory Developments in Section 316(b),
W79-05757 5C

MILLER, C. I.
Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida,
W79-05839 5C

MILLER, D. M.
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

MILLER, G. J.
Survival of Fishes and Macroinvertebrates Impinged at Oyster Creek Generating Station,
W79-05773 5C

MILLER, J. A.
Geologic and Geophysical Data from Osceola National Forest, Florida,
W79-05605 5A

MILLER, J. B.
Redox Potentials in a Cropped Potato Processing Waste Water Disposal Field with a Deep Water Table,
W79-05822 5B

MILLER, J. C.
Preliminary Studies on the Operating Aspects of Small Slot Width Wedgewire Screens with Conceptual Designs for Power Station Use,
W79-05787 8I

MILLER, J. E.
Modeling Nitrogen, Oxygen, Chattahoochee River, GA.,
W79-05974 5B

MILLS, L. R.
Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

MINOR, M. M.
Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

MINTZ, M. S.
Design, Construction, Field Testing and Cost Analysis of an Experimental Electrodialysis Demineralizer for Brackish Waters,
W79-05651 3A

MIYAZAKI, T.
Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

MOE, R. A.
The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

MOEGLICH, K.
Process and Apparatus for Removal of Contaminants from Water,
W79-05957 5D

MOLOT, L.
Report on Zooplankton Community Grazing Experiments Conducted on Board the NOAA Ship, Discoverer, in the Bering Sea, May-June 1977,
W79-05918 5C

MONKE, E. J.
Subsurface Drainage Model with Associated Sediment Transport,
W79-05802 2J

MONTEITH, J. L.
Dew and Thermal Lag: A Model for Cocoa Pods,
W79-05856 2B

MOOLEY, D. A.
Computation of the Average Precipitation Over the Western Part of Peninsular India During the Summer Monsoon From the Continuity Equation for Atmospheric Water Vapour,
W79-05619 2B

MOORE, I. D.
Effects of Drainage Projects on Runoff from Depressional Watersheds,
W79-05979 4A

MOORE, J. W.
Importance of Algae in the Diet of the Oligochaetes Lumbriculus Variegatus (Muller) and Rhyacodrulus Sodalis (Eisen),
W79-05517 5C

MORALES, M.
Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water,
W79-05643 5B

MORGAN, R. M.
The Use of Computers to Nozzle Center Pivot Systems,
W79-05995 3F

MORITA, R. Y.
Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

MORRELL, S. H.
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

MORRIS, E. M.
The Effect of the Small-Slope Approximation and Lower Boundary Conditions on Solutions of the Saint-Venant Equations,
W79-05938 2E

MORTON, F.
Study of Oriented Cellulose Membranes for Reverse Osmosis and the Relationship Between Morphology and Salt Rejection,
W79-05879 3A

MUCKLESTON, K. W.
Center Pivot Irrigation in the Columbia Basin of Washington and Oregon: Dynamics and Implications,
W79-05818 3F

MUELLER, J. A.
Contaminants Entering the New York Bight: Sources, Mass Loads, Significance,
W79-05690 5B

MUNDA, I. M.
Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

MURARKA, I. P.
Statistical Comparison and Choices of Sampling Designs for Estimating Fish Impingement at Cooling Water Intakes,
W79-05776 5C

MURCHELANO, R. A.
Fin Rot Disease Studies in the New York Bight,
W79-05702 5C

MURPHY, G. W.
Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

MURPHY, G. W.

The Minimum Requirements for Sea Water Conversion Processes,
W79-05576 3A

Theoretical Studies of the Behavior of Ions in Aqueous Solutions of Mixed Electrolytes with Respect to Osmionic Operation,
W79-05647 3A

MURPHY, T. J.
An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

MURRAY, S. N.
Patterns of Algal Succession in a Perturbated Marine Intertidal Community,
W79-05664 5C

MURTHY, M. S.
Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

MUSSALLI, Y. G.
Engineering Implications of New Fish Screening Concepts,
W79-05785 8I

MYERS, B. M.
Proceedings of the First Membership Conference of the National Water Data Exchange, May 9-11, 1978, Denver, Colorado,
W79-05585 7C

MYHERS, A. S.
Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

MYHRES, A. S.
Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

NAGEL, H. G.
Comparison of Evapotranspiration Rates in the Platte River in Nebraska: 1938 vs 1978,
W79-05798 2D

NAIDITCH, S.
Research on Role of Ligand Molecules on Ionization Potentials,
W79-05864 3A

NAKAS, J. P.
Bacterial Flux in Some New Jersey Estuarine Sediments,
W79-05704 2L

NAUMAN, J. W.
Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

NAVARRE, J. L.
An Automatic Sequential Rain Sampler,
W79-05847 7B

NEITZEL, D. A.
Comparative Fish Impingement at Two Adjacent Water Intakes on the Mid-Columbia River,
W79-05775 5C

NELSON, D. W.
Chemistry of Phosphorus, Cadmium, Copper, Nickel, Lead, and Zinc in Indiana Lake and Reservoir Sediments,
W79-05794 5B

NELSON, J.
Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

NEPTUNE, W. E.
Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

NIELSON, R. F.
Potential for Using Saline Waste Water from Electrical Power Plants for Irrigation,
W79-05829 3C

NIEMEYER, G.
Long Wave Model Independent of Stability Criteria,
W79-05534 2L

NOKES, J. M.
Proceedings of the First Membership Conference of the National Water Data Exchange, May 9-11, 1978, Denver, Colorado,
W79-05585 7C

NORBERG, C. F.
Investigation and Development of an Electrolytic System for the Conversion of Saline and Brackish Waters,
W79-05579 3A

NORWINE, J.
Twentieth-Century Semi-Arid Climates and Climatic Fluctuations in Texas and Northeastern Mexico,
W79-05563 2A

NYSEWANDER, D.
The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

NYSEWANDER, D. R.
Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

O'CLAIR, C. E.
Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

O'CONNOR, J. M.
Survival of Planktonic Organisms Following Passage Through a Simulated Power Plant Condenser Tube,
W79-05763 5C

O'CONNORS, H. B. JR.
Raritan Bay as a Source of Ammonium and Chlorophyll A for the New York Bight Apex,
W79-05693 5B

O'REILLY, J. E.
Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

OAKLEY, S. M.
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

OBCEMEA, W. N.
Ammonia Volatilization Losses from Flooded Rice Soils,
W79-05812 2K

ODEGAARD, H. A.
Application of LANDSAT Imagery for Snow Mapping in Norway,
W79-05617 7B

ODER, R.
Clamp-On Drilling Centralizer Permits Precise Direction Control,
W79-05999 8A

OFFIELD, T. W.
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

OGLE, J. K.
Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

OLCOTT, P. G.
Physiography and Surficial Geology of the Copper-Nickel Study Region, Northeastern Minnesota,
W79-05984 7C

OLSEN, C. R.
Suspended Particulate Concentrations and Compositions in the New York Bight,
W79-05687 5C

OLSON, L. C.
Drive Means for Irrigation System,
W79-05954 3F

OLSSON, K. A. G.
Method and Apparatus for Removing Filterable Substances from a Liquid,
W79-05955 5D

ONSTAD, C. A.
Residue and Tillage Effects on SCS Runoff Curve Numbers,
W79-05980 2E

ORME, E. D.
Chemistry of Phosphorus, Cadmium, Copper, Nickel, Lead, and Zinc in Indiana Lake and Reservoir Sediments,
W79-05794 5B

ORMEROD, W. E.
The Relationship Between Economic Development and Ecological Degradation: How Degradation has Occurred in West Africa and How Its Progress Might be Halted,
W79-05565 6B

OSTREM, G.
Application of LANDSAT Imagery for Snow Mapping in Norway,
W79-05617 7B

OVERCASH, M. R.
Monitoring Areawide Rural Water Quality,
W79-05842 5A

OVERMAN, A. R.
Effluent Irrigation of Coastal Bermuda Grass,
W79-05624 3C

PAGE, T. L.
Comparative Fish Impingement at Two Adjacent Water Intakes on the Mid-Columbia River,
W79-05775 5C

PALUMBO, A. V.
Distribution of Suspended Bacteria in the Newport River Estuary, North Carolina,
W79-05623 2L

APADAKIS, J. S.
Benthic Colonization Processes--A Review and a Proposed New Model,
W79-05707 5C

AREEK, R. S.
A Statistical Study of the Annual Rainfall in the Sutlej Catchment and Annual Run-Off at Bhakra Dam Site,
W79-05628 2B

ARIS, J. F.
Comparison of 2.8- and 21-Cm Microwave Radiometer Observations over Soils with Emission Model Calculations,
W79-05633 7B

ARKER, J. H.
Raritan Bay as a Source of Ammonium and Chlorophyll A for the New York Bight Apex,
W79-05693 5B

ARKINSON, C. L.
A Large-Scale Numerical Model of Sea Ice,
W79-05632 2C

ATTEN, L. R.
Effects of Petroleum Exposure on the Breeding Ecology of the Gulf of Alaska Herring Gull Group and Reproductive Ecology of Large Gulls in the Northeast Gulf of Alaska,
W79-05923 5C

ATTEN, S. M. JR.
Effects of Petroleum Exposure on the Breeding Ecology of the Gulf of Alaska Herring Gull Group and Reproductive Ecology of Large Gulls in the Northeast Gulf of Alaska,
W79-05923 5C

ATTERSON, J. W.
Technology and Economics of Industrial Pollution Abatement,
W79-05865 5B

AUL, A. J.
Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

AUSTIAN, S. J.
The Suspended Sediment Regime of an Oregon Coast Range Stream,
W79-05846 2J

AYNE, L. K.
Surface Water Quality Associated with the Surface Mining of Iowa Coal,
W79-05834 5B

EACOCK, C. D. JR.
Effect of Septic Tank Effluent on the Base Status of Two Tile-Drained Soils,
W79-05945 5B

EARCE, J. B.
Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

EARSON, F. J.
The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

ENA-CORTES, R.
Chemical, Physical, Biochemical, and Bacteriological Characteristics at Selected Stream Sites in Puerto Rico, 1967-77,
W79-05967 7A

ESCETTO, J. R.
Adjustable Bubbler Sprinkler Head,
W79-05960 3F

PETERSEN, M.
Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

PETERSEN, M. R.
Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

PETERSON, E. C.
Sewage Osmosis System,
W79-05950 5D

PETRIE, G. M.
Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

PEVERLY, J. H.
Nitrogen and Phosphorus Losses from Organic Soils,
W79-05823 5B

PHILLIPS, C. J.
Predicting Sand Deposition at Porous Fences,
W79-05533 2J

PHOEL, W. C.
Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

PIETZ, R. I.
Zinc and Cadmium Contents of Agricultural Soils and Corn in Northwestern Indiana,
W79-05947 5B

PIKITCH, E. K.
Possibilities for Assessment of the Effects of Power Plant Operation at the Ecosystem Level,
W79-05780 5C

PILOTTE, J. O.
Detection of Heavy Metal Pollution in Estuarine Sediments,
W79-05850 5B

PITCHER, K.
Biology of the Harbor Seal, Phoca Vitulina Richardi, in the Gulf of Alaska,
W79-05669 5C

Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

PLOTKIN, S. E.
Water and Energy in the Western Coal Lands,
W79-05845 6D

POJE, G. V.
Survival of Planktonic Organisms Following Passage Through a Simulated Power Plant Condenser Tube,
W79-05763 5C

PONCE, V. M.
Simplified Muskingum Routing Equation,
W79-05536 2E

POON, C. P. C.
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

POWELL, J. H.
Design, Construction, Field Testing and Cost Analysis of an Experimental Electrodialysis Demineralizer for Brackish Waters,
W79-05651 3A

PRATT, P. F.
Leaching of Cations and Chloride from Manure Applied to an Irrigated Soil,
W79-05931 5B

PRICE, V. JR.
National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

PRIEST, P.
An Automatic Sequential Rain Sampler,
W79-05847 7B

PRINGLE, J. C.
Simazine Residue Levels in Irrigation Water After Ditchbank Application for Weed Control,
W79-05821 5B

PROMISE, J.
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

A Demonstration of Areawide Water Resources Planning--Users Manual,
W79-05715 6A

PRUDIC, D. E.
Installation of Water- and Gas-Sampling Wells in Low-Level Radioactive-Waste Burial Trenches, West Valley, New York,
W79-05970 5B

PURDUE, J. O.
Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

PUTMAN, A. A.
A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

QUINLAN, S. E.
Community Structure of Seabirds of Wooded Island, Alaska,
W79-05900 5C

QUINONES-MARQUEZ, F.
Chemical, Physical, Biochemical, and Bacteriological Characteristics at Selected Stream Sites in Puerto Rico, 1967-77,
W79-05967 7A

QURESHI, R. H.
Electron Probe Microanalysis of Calcite Grains Containing Phosphorus in Soil,
W79-05810 2G

Electron Probe Microanalytical Studies of Phosphorus Distribution Within Soil Fabric,
W79-05809 2G

RABE, K.
Ocean-Atmosphere Interactions Off the Northeast Coast of North America,
W79-05681 5B

RABEN, I. A.
An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

RADIA, P.
Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

RADOK, U.
Climatic Roles of Ice: A Contribution to the International Hydrological Programme (IHP),
W79-05527 2C

RAGONE, S. E.
Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

RAHE, T. M.
Transport of Antibiotic-Resistant Escherichia Coli Through Western Oregon Hillslope Soils Under Conditions of Saturated Flow,
W79-05932 5B

RAINES, G. L.
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

RAINES, R. W.
Simazine Residue Levels in Irrigation Water After Ditchbank Application for Weed Control,
W79-05821 5B

RAMASWAMY, C.
A Study of Large Floods in the Thambraparani River in Tamil Nadu,
W79-05629 2E

RANGO, A.
The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

RAO, V. S.
A Study of Large Floods in the Thambraparani River in Tamil Nadu,
W79-05629 2E

RASMUSSEN, L. A.
Flight Path Curvature Distortion in Side-Looking Airborne Radar Imagery,
W79-05973 7B

RAWLS, W. J.
Classification of Evaluation of Flood Flow Frequency Estimation Techniques,
W79-05844 2E

Residue and Tillage Effects on SCS Runoff Curve Numbers,
W79-05980 2E

REARDON, R. D.
Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

REDMAYNE, W. H.
Water Treatment,
W79-05948 5D

REICHENBAUGH, R. C.
Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

REID, F. M. H.
An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

REINHARDT, J. J.
Tough Environmental Requirements Demand New Approaches to Landfill,
W79-05505 5E

RENEAU, R. B. JR.
Effect of Septic Tank Effluent on the Base Status of Two Tile-Drained Soils,
W79-05945 5B

RICE, R. A.
Freezing Process Studies,
W79-05653 3A

RICH, L. G.
Solids Control in Effluents from Aerated Lagoon Systems,
W79-05828 5D

RICHARDS, R. T.
Present Engineering Limitations to the Protection of Fish at Water Intakes,
W79-05790 8I

RIEDEL, J. T.
Probable Maximum Precipitation Estimates, United States East of the 105th Meridian,
W79-05863 2B

RILEY, R.
Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

RINALDI, S.
Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

RINALDO-LEE, M. B.
Hydrogeology and Computer Model of the Bass Lake Area, St. Croix County, Wisconsin,
W79-05795 2H

RING, L.
Determining Center-Pivot Sprinkler Uniformities,
W79-05996 3F

RODSTROM, W.
Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5C

ROGERS, G. D.
Entrainment of Crustacean Zooplankton Through Fort Calhoun Station,
W79-05767 5C

ROGERS, L. H.
Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

ROMAIRE, R. P.
Predicting Nighttime Oxygen Depletion in Catfish Ponds,
W79-05800 2H

ROMANO, P.
Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

RONDORF, D. W.
Assessment of a Cooling Lake Ecosystem,
W79-05964 2H

RONNEAU, C.
An Automatic Sequential Rain Sampler,
W79-05847 7B

ROSE, A.
Research on Salt Water Purification by Freezing,
W79-05881 3A

ROSE, J.
Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

ROSE, K. E.
Effect of Climatic Warming on the West Antarctic Ice Sheet,
W79-05528 2C

ROSENEAU, D. G.
Ecological Studies of Colonial Seabirds at Cape Thompson and Cape Lisburne, Alaska,
W79-05892 5C

ROSENFIELD, A.
Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

ROSENZWEIG, M.
The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

ROSICH, R.
A Phosphorus Budget for Lake Burley Griffin and Management Implications for Urban Lakes,
W79-05734 5C

ROUDYBUSH, T.
Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

ROWE, G. T.
Benthic-Pelagic Coupling in the New York Bight,
W79-05706 5C

RUDY, K. C.
A Review of Phytoplankton Studies in Lake Livingston, Texas,
W79-05806 5C

RUGH, D.
Baseline Characterization of Marine Mammals in the Bering Sea: Distribution and Abundance,
W79-05665 5C

RUNNEGAR, M. T.
Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

RUSHTON, K. R.
Possible Mechanisms for Leakage Between Aquifers and Rivers,
W79-05851 2F

SAILA, S. B.
Benthic Colonization Processes--A Review and a Proposed New Model,
W79-05707 5C

SALUJA, P. P. S.
The Study of Ionic Solvation,
W79-05658 1A

SANDBERG, G. W.
Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

SANDELL, D. J.
Development of the Direct Freeze Separation Process,
W79-05644 3A

SANDERSON, T. J. O.
Effect of Climatic Warming on the West Antarctic Ice Sheet,
W79-05528 2C

SANDSTROM, H.
Migrating Thermal Structure in a Freshwater Thermocline,
W79-05636 2H

SANGER, G.
The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

SANGHI, A. K.
Determination of Optimal Well Capacities for Continuous Irrigation Programs,
W79-05825 3F

SANTOS, E. S.
Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

SAYLER, G. S.
Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

SCHALSCHA, E. B.
Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water,
W79-05643 5B

SCHELL, D. M.
Nutrient Dynamics in Nearshore Under-Ice Waters,
W79-05920 5C

SCHIRADO, T.
Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water,
W79-05643 5B

SCHLESINGER, W. H.
Community Structure, Dynamics and Nutrients Cycling in the Okefenokee Cypress Swamp-Forest,
W79-05746 5C

SCHMID, W. E.
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

SCHMIDT, K. D.
Evaluation of Proposed TG and E (Tucson Gas and Electric Company) Wastewater Discharge on Groundwater in the Tucson Basin,
W79-05519 5E

SCHMUGGE, T.
Comparison of 2.8- and 21-Cm Microwave Radiometer Observations over Soils with Emission Model Calculations,
W79-05633 7B

Dielectric Constants of Soils at Microwave Frequencies--II,
W79-05861 2G

SCHNEIDER, D. E.
Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

SCHNEIDER, P. A. JR.
Hydrologic Data for Water-Table Aquifers in the Boulder--Fort Collins--Greeley Area, Front Range Urban Corridor, Colorado,
W79-05594 7C

SCHRAMM, G.
Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

SCHREINER, L. C.
Probable Maximum Precipitation Estimates, United States East of the 105th Meridian,
W79-05863 2B

SCHWARZ, R. C.
Process for Protecting Asbestos-Cement Bearing Surfaces in Recirculating Cooling Water Systems,
W79-05949 8F

SECKEL, KARL WESLEY
Feasibility Study for Development of a Transient Three-Dimensional Groundwater Flow Model Utilizing the Finite Element Method,
W79-05799 2F

SEEPERSAD, B.
Impacts of Three Types of Power Generating Discharge Systems on Entrained Plankton,
W79-05770 5C

SEESMAN, P. A.
Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

SEGAL, B. A.
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

SEGAR, D. A.
Oxygen Depletion in the New York Bight Apex: Causes and Consequences,
W79-05694 5B

Trace Metals in the New York Bight,
W79-05691 5B

SEGINER, I.
A Note on the Economic Significance of Uniform Water Application,
W79-05816 3F

SELLIN, R. H. J.
Drag Reduction in Sewers: First Results from a Permanent Installation,
W79-05543 8B

SENNER, S. E.
Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

SETHUNATHAN, N.
Biological Hydrolysis of Parathion in Natural Ecosystems,
W79-05935 5B

Metabolism of Nitrophenols in Flooded Soils,
W79-05936 5A

SHAFER, J. M.
Synthesis and Calibration of a River Basin Water Management Model,
W79-05583 6B

SHALHEVET, J.
Grapefruit Response to Variable Salinity in Irrigation Water and Soil,
W79-05814 3C

SHAMEL, D.
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-05890 5C

SHARMA, R. K.
Perspectives on Fish Impingement,
W79-05783 5C

SHIH, S. F.
Application of Ridge Regression Analysis to Water Resources Studies,
W79-05853 2A

SHIH, W. F. P.
Application of Ridge Regression Analysis to Water Resources Studies,
W79-05853 2A

SHIMSHI, D.
The Effect of Supplemental Irrigation and Nitrogen Fertilization on Wheat (Triticum Aestivum L.),
W79-05817 2I

SHULTS, L. M.
An Amendment to RU232 Trophic Relationships Among Ice Inhabiting Phocid Seals, and RU230 Natural History of Ringed and Bearded Seals,
W79-05672 5C

Morbidity and Mortality of Marine Mammals,
W79-05668 5C

SIEGEL, D. I.
Physiography and Surficial Geology of the Copper-Nickel Study Region, Northeastern Minnesota,
W79-05984 7C

SIGMON, C. F.
Physiological Effects of 2,4-D and 2,4,5-T on Selected Aquatic Organisms,
W79-05830 5C

SIMON, C. M.
The Culture of the Diatom Chaetoceros Gracilis and Its Use as a Food for Penaeid Protozoeal Larvae,
W79-05738 5C

SIMSIMAN, G. V.
Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

SINDERMANN, C. J.
Effects of Coastal Pollution on Fish and Fisheries--With Particular Reference to the Middle Atlantic Bight,
W79-05699 5C

SINGH, H. N.
Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

SINGH, R.
Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

SISNEROS, D. A.
Simazine Residue Levels in Irrigation Water After Ditchbank Application for Weed Control,
W79-05821 5B

SLACK, K. V.
Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

SMALL, M. J.
Stormwater Interception and Storage,
W79-05625 2E

SMITH, D. B.
The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

SMITH, F. W.
Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

SMITH, J. H.
Redox Potentials in a Cropped Potato Processing Waste Water Disposal Field with a Deep Water Table,
W79-05822 5B

SMITH, J. K.
Study of Oriented Cellulose Membranes for Reverse Osmosis and the Relationship Between Morphology and Salt Rejection,
W79-05879 3A

SMITH, K. L. JR.
Benthic-Pelagic Coupling in the New York Bight,
W79-05706 5C

SMITH, T.
Cam-Lock Water Gate,
W79-05951 8C

SMITH, W. G.
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

SMITH, W. H. JR.
Development of the Solvent Demineralization of Saline Water,
W79-05650 3A

SOLOMON, K.
Variability of Sprinkler Coefficient of Uniformity Test Results,
W79-05805 3F

SONCINI-SESSA, R.
Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

SOULE, P. L.
Flood-Plain Delineation for Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, and Thompson Creek, Fairfax County, Virginia,
W79-05986 6A

SOWLS, A.
Catalog of Alaskan Seabird Colonies,
W79-05902 5C

SPARKS, A. K.
Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea,
W79-05916 5C

SPIGARELLI, S. A.
Statistical Comparison and Choices of Sampling Designs for Estimating Fish Impingement at Cooling Water Intakes,
W79-05776 5C

SPISER, D. E.
Selected Water-Level Records for Oklahoma, 1975-1977,
W79-05604 2F

SPOONER, C. S.
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

A Demonstration of Areawide Water Resources Planning--Users Manual,
W79-05715 6A

SPRINGER, A. M.
Ecological Studies of Colonial Seabirds at Cape Thompson and Cape Lisburne, Alaska,
W79-05892 5C

SQUIBB, R.
Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5C

STANFORD, H. M.
Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5B

STEELE, G. N.
Research on Condensation Mechanisms,
W79-05882 3A

STEIMLE, F. W.
Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

STEINBACH, G. E.
Rapidly Obtaining Optimal Irrigation System Designs,
W79-05993 3F

STEINHAUSER, H. H.
The Minimum Requirements for Sea Water Conversion Processes,
W79-05576 3A

STEPHENSON, D. A.
Hydrogeology and Computer Model of the Bass Lake Area, St. Croix County, Wisconsin,
W79-05795 2H

STEVENS, D. E.
Mortality of Young Striped Bass Entrained at Two Power Plants in the Sacramento-San Joaquin Delta, California,
W79-05761 5C

STEWART, D. M.
Physical Measurement of Ice Jams, 1976-77 Field Season,
W79-05833 2C

STEWART, J. R.
Mortalities of the Larvae of Two Species of Bivalves after Acute Exposure to Elevated Temperature,
W79-05771 5C

STEWART, J. W. B.
Influence of the Chemical Form of Mercury on Its Adsorption and Ability to Leach Through Soils,
W79-05944 5B

The Uptake of 203Hg-Labeled Mercury Compounds by Bromegrass from Irrigated Undisturbed Soil Columns,
W79-05943 5B

STOREY, D. J.
Standard Setting and the Theory of Institutional Choice: The Case of Pollution Control,
W79-05749 6C

STORR, J. F.
Effect of Environmental Variables on Fish Impingement,
W79-05779 5C

STRAYER, R. F.
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

STRELKOFF, T.
Mathematical Models and Border Irrigation Design,
W79-05991 3F

STUBBLEFIELD, W. L.
Surficial Sediments of the NOAA-MESA Study Areas in the New York Bight,
W79-05685 5B

STULL, E. A.
Major Chemical Constituents of Arizona Lakes,
W79-05567 2H

SUCHANNEK, R. G.
Research on Role of Ligand Molecules on Ionization Potentials,
W79-05864 3A

SUDHAKAR, B.
Biological Hydrolysis of Parathion in Natural Ecosystems,
W79-05935 5B

Metabolism of Nitrophenols in Flooded Soils,
W79-05936 5A

SULLIVAN, W.
Clamp-On Drilling Centralizer Permits Precise Direction Control,
W79-05999 8A

SUMSION, C. T.
Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

SUZUKI, M.
Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

SVANOE, H.
A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

SVENSSON, G.
Some Aspects on Urban Runoff Quality Modeling,
W79-05549 5B

Swedish Urban Hydrological Research: A Review,
W79-05547 4C

SWAILEM, F. M.
Tritium Dating of Some Groundwater Samples from Northwestern Iraqi Desert,
W79-05569 2F

SWANSON, R. L.
Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5B

SWIFT, D. J. P.
Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

Surficial Sediments of the NOAA-MESA Study Areas in the New York Bight,
W79-05685 5B

SWIGER, W. F.
A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

ABER, R. C.
The Minimum Requirements for Sea Water Conversion Processes,
W79-05576 3A

AFT, E. P.
Engineering Implications of New Fish Screening Concepts,
W79-05785 8I

AGUCHI, S.
Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

AL, M.
Salt Tolerance in the Wild Relatives of the Cultivated Tomato: Responses of Solanum Pennellii to High Salinity,
W79-05813 2I

ATHAM, T. R.
Survival of Fishes and Macroinvertebrates Impinged at Oyster Creek Generating Station,
W79-05773 5C

AYLOR, R. J.
Plant Communities of Alaskan Arctic Beaches,
W79-05910 5C

EETER, A. M.
Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

HACKER, W. C.
Effects of Hindered Settling on Sediment Concentration Profiles,
W79-05542 2J

HELEN, E.
Producing Selectively Infrared-Reflecting Surfaces on Plastic Films for Solar Stills,
W79-05659 3A

THOMAS, D. L.
Survival of Fishes and Macroinvertebrates Impinged at Oyster Creek Generating Station,
W79-05773 5C

THOMAS, J. P.
Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

THOMAS, M. P.
Map Showing Drainage Areas, Collinsville Quadrangle, Connecticut,
W79-05603 7C

Map Showing Drainage Areas, Columbia Quadrangle, Connecticut,
W79-05600 7C

Map Showing Drainage Areas, New Britain Quadrangle, Connecticut,
W79-05602 7C

Map Showing Drainage Areas, Norfolk Quadrangle, Connecticut,
W79-05601 7C

THOMAS, R. H.
Effect of Climatic Warming on the West Antarctic Ice Sheet,
W79-05528 2C

THOMPSON, S.
Preliminary Design of an Experimental Containerized Freeze Desalination Unit,
W79-05727 3A

The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

THRONSON, R. E.
Nonpoint Source Control Guidance, Agricultural Activities,
W79-05811 5G

TIEDEMANN, A. R.
Stream Chemistry and Watershed Nutrient Economy Following Wildfire and Fertilization in Eastern Washington,
W79-05824 5B

TIEDJE, J. M.
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

TILLEY, L. J.
Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

TILLY, L. J.
Seasonal Cycling of Cesium-137 in a Reservoir,
W79-05622 5B

TINDALL, D. R.
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

TOMLINSON, L. M.
Possible Mechanisms for Leakage Between Aquifers and Rivers,
W79-05851 2F

TORPEY, W. N.
Wastewater Treatment,
W79-05963 5D

TOWLSON, H. E.
The Properties of Gas Hydrates and Their Use in Demineralizing Sea Water,
W79-05656 3A

TRACY, D.
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-05890 5C

TRUETT, J. C.
Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Overview and Synthesis,
W79-05927 5C

USINOWICZ, P. J.
Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

VAISHAMPAYAN, A.
Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

VAN RYSWYK, A. L.
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

VAZQUEZ, P.
Chemical, Physical, Biochemical, and Bacteriological Characteristics at Selected Stream Sites in Puerto Rico, 1967-77,
W79-05967 7A

VERBER, J. L.
Safe Shellfish from the Sea,
W79-05713 5C

VERGARA, I.
Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water,
W79-05643 5B

VETTER, R. J.
Zinc and Cadmium Contents of Agricultural Soils and Corn in Northwestern Indiana,
W79-05947 5B

VIGERSTAD, T. J.
Seasonal Cycling of Cesium-137 in a Reservoir,
W79-05622 5B

VOGEL, J. L.
Assessment of Weather Modification in Alleviating Agricultural Water Shortages During Droughts,
W79-05836 2B

VREELAND, R. H.
Bacterial Flux in Some New Jersey Estuarine Sediments,
W79-05704 2L

WALKER, J. D.
Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

WALLER, B. G.
Effects of Land Use and Water Management on Water Quality in the Western South New River Canal Basin, Southeast Florida, 1974-75,
W79-05978 4C

WALLER, R. M.
Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

WALTRIP, O. R.
Sewage Treating and Conversion Process,
W79-05962 5D

WANG, J.
Dielectric Constants of Soils at Microwave Frequencies--II,
W79-05861 2G

WANG, L. K.
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

WANG, M. H.
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

WARTHA, J. H.
Lake Erie Ice: Winter 1975-76,
W79-05615 2C

WASHINGTON, W. M.
A Large-Scale Numerical Model of Sea Ice,
W79-05632 2C

WEAVER, R. W.
Effect of Environmental Factors on Survival of Salmonella Typhimurium in Soil,
W79-05807 5B

WEBB, J. C.
A Method for Determining Growth and Mortality Rates of Ichthyoplankton,
W79-05765 5C

WEHLE, D. H. S.
Studies of Marine Birds on Ugaiushak Island,
W79-05896 5C

WELLS, D. E.
The Occurrence of Organochlorine Residues in Rainwater,
W79-05848 5A

WELSH, F.
The Cap - Who Needs It.
W79-05568 6B

WEST, G. C.
Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

WHIPPLE, W. JR.
Nonpoint Source Pollution,
W79-05582 5B

WHITE, I. L.
Water and Energy in the Western Coal Lands,
W79-05845 6D

WHITE, R. L.
Map Showing Drainage Areas, Norfolk Quadrangle, Connecticut,
W79-05601 7C

WHITEHOUSE, U. G.
Research on Liquid-Liquid Extraction for Saline Water Conversion,
W79-05654 3A

WIEDENFELD, R. P.
Cation Exchange Equilibria in a Mixed Soil System Containing Three Heterovalent Cations,
W79-05808 2G

WIEGANDT, H. F.
Saline Water Conversion by Freezing: An Intergral Processing Unit Using a Secondary Refrigerant,
W79-05880 3A

WIENS, J. A.
Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation,
W79-05885 5C

WIERSMA, J. L.
Analysis and Dissemination of Water Resources Information,
W79-05792 7C

WILDMAN, R. B.
Surface Water Quality Associated with the Surface Mining of Iowa Coal,
W79-05834 5B

WILKINSON, D. L.
Two-Dimensional Bubble Plumes,
W79-05539 8B

WILLETS, B. B.
Predicting Sand Deposition at Porous Fences,
W79-05533 2J

WILLIAMS, D.
Dielectric Constants of Soils at Microwave Frequencies--II,
W79-05861 2G

WILLIAMS, R. A.
Research on Role of Ligand Molecules on Ionization Potentials,
W79-05864 3A

WILLIAMS, R. J.
Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

WILLIS, J. C.
Statistical Analysis of Concentration Records,
W79-05535 2J

WILSON, R.
Raritan Bay as a Source of Ammonium and Chlorophyll A for the New York Bight Apex,
W79-05693 5B

WILTSHIRE, D. A.
Estuarine Research: An Annotated Bibliography of Selected Literature, With Emphasis on the Hudson River Estuary, New York and New Jersey,
W79-05593 2L

WINCHESTER, J. W.
Detection of Heavy Metal Pollution in Estuarine Sediments,
W79-05850 5B

WOHL, K. D.
Survey of Beached Marine Birds in Alaska,
W79-05903 5C

WOLANSKY, R. M.
Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

WOLFF, G. T.
Acid Precipitation in the New York Metropolitan Area: Its Relationship to Meteorological Factors,
W79-05626 2K

WOODFORD, T. A.
Growth and Elemental Composition of Corn and Bean Seedlings as Influenced by Soil Application of Coal Ash,
W79-05942 5B

WOODHAM, W. M.
Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

WRIGHT, J. C.
Wave Forces on Cylinders Near Plane Boundaries,
W79-05532 2L

WUEBBEN, J. L.
Physical Measurement of Ice Jams, 1976-77 Field Season,
W79-05833 2C

WUNDERLICH, L. D.
Distribution of Hydrographic Properties in the New York Bight Apex,
W79-05683 1A

WURSTER, T. E.
Effects of the Donald C. Cook Nuclear Power Plant on Zooplankton of Southeastern Lake Michigan,
W79-05766 5C

WYMAN, G. G.
Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida,
W79-05839 5C

YAMADA, T.
Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

YAMAMOTO, T.
Wave Forces on Cylinders Near Plane Boundaries,
W79-05532 2L

YASSO, W. E.
Developmental Tests on the Use of Fluorescent Tracers and Backwash Sediment-Load Samplers to Measure the Beach Drift Component of Littoral Transport at Sandy Hook, New Jersey,
W79-05688 2J

YEN, C-L.
Subsidence of Peak Flow in Channels with Storage Areas,
W79-05541 2E

YOPP, J. H.
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

ZEITOUN, I. H.
The Recovery and Hematological Rehabilitation of Chlorine Stressed Adult Rainbow Trout (Salmo Gairdneri),
W79-05515 5C

ZIBILSKE, L. M.
Effect of Environmental Factors on Survival of Salmonella Typhimurium in Soil,
W79-05807 5B

ZISKOWSKI, J.
Fin Rot Disease Studies in the New York Bight,
W79-05702 5C

ORGANIZATIONAL INDEX

ABBOTT LAB., NORTH CHICAGO, IL.
Effects of SO2 and NO2 on Nitrification in Soil,
W79-05940 5B

ABCOR, INC., WILMINGTON, MA. WALDEN DIV.
Growth Effects of Major Land Use Projects (Wastewater Facilities), Volume I: Model Specification and Causal Analysis,
W79-05866 6G

AEROJET - GENERAL CORP., AZUSA, CA.
The Mechanism of Desalination by Reverse Osmosis,
W79-05878 3A

AGRICULTURAL RESEARCH AND EDUCATION CENTER, BELLE GLADE.
Application of Ridge Regression Analysis to Water Resources Studies,
W79-05853 2A

AGRICULTURAL RESEARCH ORGANIZATION, BET-DAGAN (ISRAEL). DIV. OF ENVIRONMENTAL PHYSIOLOGY.
Grapefruit Response to Variable Salinity in Irrigation Water and Soil,
W79-05814 3C

AGRICULTURAL RESEARCH ORGANIZATION, BET-DAGAN (ISRAEL). DIV. OF SOIL PHYSICS.
Analysis of Trickle Irrigation with Application to Design Problems,
W79-05815 3F

AGRICULTURAL RESEARCH ORGANIZATION, GILAT (ISRAEL). REGIONAL EXPERIMENT STATION.
The Effect of Supplemental Irrigation and Nitrogen Fertilization on Wheat (Triticum Aestivum L.),
W79-05817 2I

AHMADU BELLOW UNV., ZARIA (NIGERIA), DEPT. OF CIVIL ENGINEERING.
Translatory Characteristics of the Muskingum Method of Flood Routing,
W79-05941 2E

AIR FORCE ARMAMENT LAB., EGLIN, AFB, FL.
Water Quality: Streams and Ponds on Selected Test Areas on Eglin Air Force Base, Florida,
W79-05839 5C

ALASKA DEPT. OF FISH AND GAME, ANCHORAGE.
Biology of the Harbor Seal, Phoca Vitulina Richardi, in the Gulf of Alaska,
W79-05669 5C

Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska,
W79-05673 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska,
W79-05675 5C

ALASKA DEPT. OF FISH AND GAME, FAIRBANKS.
The Natural History and Ecology of the Bearded Seal (Erignathus Barbatus) and the Ringed Seal (Phoca Hispida),
W79-05670 5C

Trophic Relationships Among Ice Inhabiting Phocid Seals,
W79-05671 5C

ALASKA UNIV., FAIRBANKS. INST. OF ARCTIC BIOLOGY.
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-05890 5C

Nutritional Significance of Copper-Bering Intertidal System to Spring-Migrating Shorebirds Breeding in Western Alaska,
W79-05904 5C

ALASKA UNIV., FAIRBANKS. INST. OF MARINE SCIENCE.
Survey of the Epifaunal Invertebrates of the Southeastern Bering Sea,
W79-05905 5C

Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, Northeast Gulf of Alaska and the Bering Sea,
W79-05908 5C

Bering Sea Ice Edge Ecosystem Study: Nutrient Cycling and Organic Matter Transfer,
W79-05917 5C

Report on Zooplankton Community Grazing Experiments Conducted on Board the NOAA Ship, Discoverer, in the Bering Sea, May-June 1977,
W79-05918 5C

Bibliography on the Transfer of Synthesized Organic Matter to Zooplankton, Micronekton, and Ichthyoplankton,
W79-05919 5C

Nutrient Dynamics in Nearshore Under-Ice Waters,
W79-05920 5C

ALASKA UNIV., FAIRBANKS. INST. OF MARINE SCIENCE; AND ALASKA UNIV., FAIRBANKS. INST. OF ARCTIC BIOLOGY.
Morbidity and Mortality of Marine Mammals,
W79-05668 5C

An Amendment to RU232 Trophic Relationships Among Ice Inhabiting Phocid Seals, and RU230 Natural History of Ringed and Bearded Seals,
W79-05672 5C

ALBERTA UNIV., EDMONTON.
Wet and Dry Deposition of Nutrients in Central Alberta,
W79-05849 5B

ALEXANDRIA UNIV. (EGYPT). DEPT. OF SOIL SCIENCE.
An Outline of Soil, Water and Agriculture in Arab Countries,
W79-05553 2A

APPLIED SCIENCE LABS. INC., STATE COLLEGE, PA.
Research on Salt Water Purification by Freezing,
W79-05881 3A

ARGONNE NATIONAL LAB., IL.
Statistical Comparison and Choices of Sampling Designs for Estimating Fish Impingement at Cooling Water Intakes,
W79-05776 5C

ARGONNE NATIONAL LAB., IL. DIV. OF ENVIRONMENTAL IMPACT STUDIES.
Perspectives on Fish Impingement,
W79-05783 5C

ARIZONA SOCIETY OF PROFESSIONAL ENGINEERS PHOENIX.
The Cap - Who Needs It.
W79-05568 6B

ARIZONA STATE UNIV. TEMPE.
Chemical and Microbiological Characteristics of Two, Recreation Oriented, Oligotrophic Mountain Lakes,
W79-05564 5C

ARIZONA STATE UNIV., TEMPE. DEPT. OF ECONOMICS.
Congestion, Pollution, and Impure Public Goods,
W79-05748 6C

ARIZONA UNIV., TUCSON.
Major Chemical Constituents of Arizona Lakes,
W79-05567 2H

ARIZONA UNIV., TUCSON. DEPT. OF SOILS, WATER AND ENGINEERING.
Mathematical Models and Border Irrigation Design,
W79-05991 3F

ARIZONA WATER RESOURCES RESEARCH CENTER, TUCSON.
Groundwater Projections for 11 Basins,
W79-05554 4B

ARMY ENGINEER DISTRICT, FORT WORTH, TX.
Flood Plain Information: Maxwell Creek, Parker, Texas,
W79-05719 2E

Flood Plain Information: Deer Creek and Tributaries, Crowley, Texas.
W79-05720 2E

ARMY ENGINEER DISTRICT, PORTLAND, OR. NORTH PACIFIC DIV.
Corps of Engineers Responsibilities and Actions to Maintain Columbia Basin Anadromous Fish Runs,
W79-05510 5C

ARMY ENGINEERS DISTRICT, PORTLAND, OR.
Review Report on Umpqua River and Tributaries, Oregon, Interim Report, South Umpqua River, Volume III; (Appendix B--Hydrology, Meteorology, and Reservoir Regulation; Appendix C--Foundation and Materials Data; Appendix D--Recreation, Public Use, and Environment),
W79-05616 8A

ARMY TERRESTRIAL SCIENCES CENTER, HANOVER, NH. APPLIED RESEARCH BRANCH.
Physical Measurement of Ice Jams, 1976-77 Field Season,
W79-05833 2C

ARMY TERRESTRIAL SCIENCES CENTER, HANOVER, NH. SNOW AND ICE BRANCH.
River Ice,
W79-05860 2C

ATOMIC INDUSTRIAL FORUM, INC., WASHINGTON, DC.
Documentation of Data and Literature Relevant to the Assessment of Thermal Power Plant Cooling System Effects on Aquatic Environments,
W79-05784 5C

AUBURN UNIV., AL. WATER RESOURCES RESEARCH INST.

The Effect of Water Pollution Control Regulations on the Cost of Production of Electric Power,
W79-05796 6B

Predicting Nighttime Oxygen Depletion in Catfish Ponds,
W79-05800 2H

AUTOTROL CORP., MILWAUKEE, WI. (ASSIGNEE).

Wastewater Treatment,
W79-05963 5D

B. P. PETROLEUM DEVELOPMENT LTD., ABERDEEN (SCOTLAND).

Predicting Sand Deposition at Porous Fences,
W79-05533 2J

BANARAS HINDU UNIV., VARANASI (INDIA). DEPT. OF BOTANY.

Biological Effects of Rice-Field Herbicide Machete on Various Strains of the Nitroge-Fixing Blue-Green Alga Nostoc Muscorum,
W79-05744 5C

BATTELLE MEMORIAL INST., COLUMBUS, OH.

Research Investigations of Multiple-Effect Evaporation of Saline Waters by Steam from Solar Radiation,
W79-05573 3A

A Study and Development of the Hickman Sea-Water Still,
W79-05869 3A

Corrosion of Metals in Sea Water,
W79-05870 3A

BATTELLE PACIFIC NORTHWEST LAB., RICHLAND, WA.

Water Quality Models for Municipal Water Supply Reservoirs, Part I. Summary,
W79-05728 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 2. Model Formulation, Calibration and Verification,
W79-05729 5C

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WA.

Water Quality Models for Municipal Water Supply Reservoirs. Part 3. User's Manual,
W79-05730 5C

Water Quality Models for Municipal Water Supply Reservoirs. Part 4. Mt. Bold Reservoir Data Aquisition and Evaluation,
W79-05731 5C

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WA. ECOSYSTEMS DEPT.

Comparative Fish Impingement at Two Adjacent Water Intakes on the Mid-Columbia River,
W79-05775 5C

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WA. WATER AND LAND RESOURCES DEPT.

The Transmissivity Iterative Calculation Routine--Theory and Numerical Implementation,
W79-05614 7C

BATTELLE PACIFIC NORTHWEST LABS., SEQUIM, WA. MARINE RESEARCH LAB.

Research to Determine the Accumulation of Organic Constituents and Heavy Metals from Petroleum-Impacted Sediments by Marine Detritivores of the Alaskan Outer Continental Shelf,
W79-05926 5C

BEAK CONSULTANTS LTD., MISSISSAUGA (ONTARIO).

Impacts of Three Types of Power Generating Discharge Systems on Entrained Plankton,
W79-05770 5C

BECHTEL CORP., LOS ANGELES, CA.

A Study of Large Size Saline Water Conversion Plants.
W79-05663 3A

BEDFORD INST. OF OCEANOGRAPHY, DARTMOUTH (NOVA SCOTIA).

Migrating Thermal Structure in a Freshwater Thermocline,
W79-05636 2H

BEDFORD INST. OF OCEANOGRAPHY, DARTMOUTH (NOVA SCOTIA). MARINE ECOLOGY LAB.

Seasonal Changes in Oxygen Uptake by Settled Particulate Matter and Sediments in a Marine Bay,
W79-05638 2L

Loss Rates of Suspended Material Sedimented in a Marine Bay,
W79-05639 2L

Origin of Deposited Material Sedimented in a Marine Bay,
W79-05640 2L

BEN-GURION UNIV. OF THE NEGEV, BEERSHEBA (ISRAEL). DEPT. OF BIOLOGY.

Salt Tolerance in the Wild Relatives of the Cultivated Tomato: Responses of Solanum Pennellii to High Salinity,
W79-05813 2I

BERGEN UNIV. (NORWAY). GEOPHYSICAL INST.

Melting of Ice in Sea Water: A Primitive Model with Application to the Antarctic Ice Shelf and Icebergs,
W79-05857 2C

BETZ LABS., INC., TREVOSE, PA. (ASSIGNEE).

Process for Protecting Asbestos-Cement Bearing Surfaces in Recirculating Cooling Water Systems,
W79-05949 8F

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.

Possible Mechanisms for Leakage Between Aquifers and Rivers,
W79-05851 2F

BJORKSTEN RESEARCH LAB., INC., MADISON, WI.

Development of Plastics Solar Stills.
W79-05660 3A

BRISTOL UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.

Drag Reduction in Sewers: First Results from a Permanent Installation,
W79-05543 8B

BRISTOL UNIV. (ENGLAND). SCHOOL OF CHEMISTRY.

The Presence of Pollutant Hydrocarbons in Estuarine Epipelic Diatom Ppopulations. II. Diatom Slimes,
W79-05884 5C

BRITISH COLUMBIA MINISTRY OF THE ENVIRONMENT, KAMLOOPS.

Equilibrium and Actual Evapotranspiration from a Very Dry Vegetated Surface,
W79-05529 2D

BROOKLYN COLL., NEW YORK. DEPT. OF BIOLOGY.

Distribution and Abundance of Inshore Populations of the Surf Clam Spisula Solidissima,
W79-05710 5C

BROOKLYN COLL., NY. DEPT. OF GEOLOGY.

Spatial and Temporal Variation in Sedimentary Grain-Size Facies and Sediment Heavy Metal Ratios in the New York Bight Apex,
W79-05686 5C

BUREAU OF RECLAMATION, DENVER, CO.

Mean Air Concentration of Self-Aerated Flow,
W79-05537 8B

BUREAU OF RECLAMATION, DENVER, CO. ENGINEERING AND RESEARCH CENTER.

Demineralization of Saline Waters: A Preliminary Discussion of a Research Program,
W79-05655 3A

BUREAU OF RECLAMATION, WASHINGTON, DC.

Potential Use of Converted Sea Water for Irrigation in Parts of California and Texas,
W79-05645 3A

BURNS AND ROE, INC., PARAMUS, NJ.

Present Engineering Limitations to the Protection of Fish at Water Intakes,
W79-05790 8I

BURNS AND ROE INDUSTRIAL SERVICES CORP., PARAMUS, NJ.

Parametric Study on Brackish Water Membrane Desalting Plants,
W79-05501 3A

CALIFORNIA POLYTECHNIC STATE UNIV., SAN LUIS OBISPO. DEPT. OF AGRICULTURAL ENGINEERING.

Border-Strip Irrigation Design--Practical Approach from a Theoretical Basis,
W79-05992 3F

CALIFORNIA STATE DEPT. OF FISH AND GAME, STOCKTON.

Mortality of Young Striped Bass Entrained at Two Power Plants in the Sacramento-San Joaquin Delta, California,
W79-05761 5C

Fisheries Issues Related to Water Development in the Sacramento-San Joaquin Estuary, California,
W79-05789 6G

CALIFORNIA STATE UNIV., FULLERTON. DEPT. OF BIOLOGICAL SCIENCE.

Patterns of Algal Succession in a Perturbated Marine Intertidal Community,
W79-05664 5C

CALIFORNIA UNIV., BERKELEY. DEPT. OF SOILS AND PLANT NUTRITION.

Precipitation and Throughfall Chemistry in the San Francisco Bay Area,
W79-05937 5B

CALIFORNIA UNIV., BODEGA BAY. BODEGA MARINE LAB.
Shorebird Dependence on Arctic Littoral Habitats,
W79-05886 5C

CALIFORNIA UNIV., DAVIS. DEPT. OF SOIL MICROBIOLOGY.
Timing and Rate of Fertilizer Nitrogen for Sugarbeets Related to Nitrogen Uptake and Pollution Potential,
W79-05939 5B

CALIFORNIA UNIV., IRVINE.
Reproductive Ecology, Foods and Foraging Areas of Seabirds Nesting on the Pribilof Islands,
W79-05678 5C

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF HISTORY.
The Dark and Bloody Ground of Indian Water Rights: Confusion Elevated to Principle,
W79-05560 6E

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCE.
Leaching of Cations and Chloride from Manure Applied to an Irrigated Soil,
W79-05931 5B

CALIFORNIA UNIV., SAN DIEGO, LA JOLLA. INST. OF MARINE RESOURCES.
An Unusual Occurrence of Hemiaulus Membranaceus Cleve (Bacillariophyceae) with Richelia Intracellularis Schmidt (Cyanophyceae) Off the Coast of Southern California in October 1976,
W79-05741 5C

CALIFORNIA UNIV., SANTA BARBARA. DEPT. OF BIOLOGICAL SCIENCES.
Community Structure, Dynamics and Nutrients Cycling in the Okefenokee Cypress Swamp-Forest,
W79-05746 5C

CAMBRIDGE UNIV. (ENGLAND). ENGINEERING LAB.
Waves in Front of Long-Based Weirs,
W79-05540 8B

CANADA ENVIRONMENTAL PROTECTION SERVICE, YELLOWKNIFE (NORTHWEST TERRITORIES).
Importance of Algae in the Diet of the Oligochaetes Lumbriculus Variegatus (Muller) and Rhyacodrulus Sodalis (Eisen),
W79-05517 5C

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND). DEPT. OF CIVIL ENGINEERING.
An Analysis of the Groundwater Resources of Tongatapu Island, Kingdom of Tonga,
W79-05827 2F

CENTRAL ARID ZONE RESEARCH INST. JODHPUR (INDIA).
Traditional Perceptabilities (Sic.) of Environment and Desertification: A Case Study,
W79-05562 6B

CENTRAL RICE RESEARCH INST., CUTTACK (INDIA). LAB. OF SOIL MICROBIOLOGY.
Biological Hydrolysis of Parathion in Natural Ecosystems,
W79-05935 5B

Metabolism of Nitrophenols in Flooded Soils,
W79-05936 5A

CHADRON STATE COLL., NE.
Surface and Groundwater Study of the White River, Osawes County, Nebraska,
W79-05801 2A

CHALMERS UNIV. OF TECHNOLOGY, GOTEBORG (SWEDEN).
Swedish Urban Hydrological Research: A Review,
W79-05547 4C

Estimation of Transmissivity and Permeability in Swedish Bedrocks,
W79-05551 2F

Injection of Water Into Wells for Investigation of Limited Aquifer,
W79-05552 4B

CHALMERS UNIV. OF TECHNOLOGY, GOTEBORG (SWEDEN). DEPT. OF HYDRAULICS.
Some Results from Urban Runoff Studies in Bergsjon Goteborg,
W79-05548 2A

CHALMERS UNIV. OF TECHNOLOGY, GOTEBORG (SWEDEN). DEPT. OF WATER SUPPLY AND SEWERAGE.
Some Aspects on Urban Runoff Quality Modeling,
W79-05549 5B

CHELAN COUNTY PUBLIC UTILITY DISTRICT NO. 1, WENATCHEE, WA.
The Mid-Columbia Public Utility Responsibility,
W79-05511 5C

CHILE UNIV., SANTIAGO. DEPT. OF INORGANIC AND ANALYTICAL CHEMISTRY.
Nitrate Movement in a Chilean Agricultural Area Irrigated with Untreated Sewage Water,
W79-05643 5B

CITY COLL., NEW YORK. DEPT. OF BIOLOGY.
Phytoplankton Productivity in the Apex of the New York Bight: Environmental Regulation of Productivity/Chlorophyll A,
W79-05697 5B

CLEMSON UNIV., SC. DEPT. OF ZOOLOGY.
Physiological Effects of 2,4-D and 2,4,5-T on Selected Aquatic Organisms,
W79-05830 5C

CLEMSON UNIV., SC. WATER RESOURCES RESEARCH INST.
Solids Control in Effluents from Aerated Lagoon Systems,
W79-05828 5D

COASTAL CULVERT AND SUPPLY, INC., EUNICE, LA. (ASSIGNEE).
Cam-Lock Water Gate,
W79-05951 8C

COASTAL ENGINEERING RESEARCH CENTER, FORT BELVOIR, VA.
Longshore Transport at a Total Littoral Barrier,
W79-05838 2H

COLLEGE OF THE ATLANTIC, BAR HARBOR, ME.
Ecological Studies in the Northern Bering Sea: Birds of Coastal Habitats on the South Shore of Seward Peninsula, Alaska,
W79-05888 5C

Ecological Studies in the Northern Bering Sea: Studies of Seabirds in the Bering Strait,
W79-05891 5C

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Simplified Muskingum Routing Equation,
W79-05536 2E

Synthesis and Calibration of a River Basin Water Management Model,
W79-05583 6B

COLORADO UNIV., BOULDER.
Climatic Roles of Ice: A Contribution to the International Hydrological Programme (IHP),
W79-05527 2C

COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION (U.S. HOUSE).
The Power Plant Regulatory Program: A Congressional Dilimma,
W79-05756 5C

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, PARKVILLE AUSTRALIA). DIV. OF PROTEIN CHEMISTRY.
Isolation, Characterization and Pathology of the Toxin from a Microcystis Aeruginosa (=Anacystis Cynea) Bloom,
W79-05743 5C

CONCENTRATION SPECIALISTS, INC., ANDOVER, MA.
Preliminary Design of an Experimental Containerized Freeze Desalination Unit,
W79-05727 3A

CONSOLIDATED PAPERS INC., WISCONSIN RAPIDS, WI.
Combined Effluents from Three Mills are Handled by Single New Facility,
W79-05507 5D

CONSUMERS POWER CO., JACKSON, MI. DEPT. OF ENVIRONMENTAL SERVICES.
The Recovery and Hematological Rehabilitation of Chlorine Stressed Adult Rainbow Trout (Salmo Gairdneri),
W79-05515 5C

CORNELL UNIV. AGRICULTURAL EXPERIMENT STATION, ITHACA, NY. DEPT. OF AGRONOMY.
Nitrogen and Phosphorus Losses from Organic Soils,
W79-05823 5B

CORNELL UNIV., ITHACA, NY. SCHOOL OF CHEMICAL AND METALLURGICAL ENGINEERING.
Saline Water Conversion by Freezing: An Intergral Processing Unit Using a Secondary Refrigerant,
W79-05880 3A

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR.
The Importance of Water Quality to Columbia River Salmon and Steelhead,
W79-05512 5C

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR. MARINE AND FRESHWATER ECOLOGY BRANCH.
Preliminary Analysis of the Dispersion of Sewage Sludge Discharged from Vessels to New York Bight Waters,
W79-05692 5B

DEPARTMENT OF AGRICULTURE, LETHBRIDGE (ALBERTA).
Determining Center-Pivot Sprinkler Uniformities,
W79-05996 3F

DEPARTMENT OF AGRICULTURE, SWIFT CURRENT (SASKATCHEWAN).
Nitrogen Inputs and Losses in Tobacco, Bean, and Potato Fields in a Sandy Loam Watershed,
W79-05819 5B

DEPARTMENT OF GEOLOGY AND GEOPHYSICS, UNIVERSITY OF WISCONSIN-MADISON.
Hydrogeology and Computer Model of the Bass Lake Area, St. Croix County, Wisconsin,
W79-05795 2H

DEPARTMENT OF THE ENVIRONMENT, READING (ENGLAND). CENTRAL WATER PLANNING UNIT.
The Flow Mechanism in the Chalk Based on Radio-Isotope Analyses of Groundwater in the London Basin,
W79-05852 2F

DEPAUL UNIV., CHICAGO, IL.
An Economic Analysis of Phosphorus Control and Other Aspects of R76-1,
W79-05752 6E

DETROIT EDISON CO., MI. ENGINEERING RESEARCH DEPT.
A Conceptual Model of Causal Factors Regarding Gizzard Shad Runs at Steam Electric Power Plants,
W79-05778 5C

DU PONT DE NEMOURS (E. I.) AND CO., AIKEN, SC. SAVANNAH RIVER LAB.
National Uranium Resource Evaluation Program (NURE), Hydrogeochemical and Stream Sediment Reconnaissance in the Eastern United States,
W79-05520 5A

ECOLOGICAL ANALYSTS, INC., MIDDLETOWN, NY.
Survival of Entrained Ichthyoplankton and Macroinvertebrates at Hudson River Power Plants,
W79-05762 5C

Impingement Survival Studies on White Perch, Striped Bass, and Atlantic Tomcod at Three Hudson River Power Plants,
W79-05772 5C

An Approach for the Analysis of Striped Bass Entrainment Survival at Hudson River Power Plants,
W79-05782 5C

ECOSYSTEMS INTERNATIONAL, INC., GAMBRILLS, MD.
Applications of Remote Sensing to Water Resources,
W79-05840 7B

EDINBURGH UNIV. (SCOTLAND). DEPT. OF METEOROLOGY.
Regional Mean Bowen Ratios Deduced from Diurnal Changes of Temperature and Humidity,
W79-05883 2A

EMTEC, INC., HOUSTON, TX.
Clamp-On Drilling Centralizer Permits Precise Direction Control,
W79-05999 8A

ENVIRONMENTAL PROTECTION AGENCY, CHICAGO, IL. ENFORCEMENT DIV.
Regulatory Developments in Section 316(b),
W79-05757 5C

ENVIRONMENTAL PROTECTION AGENCY, DENVER, CO. REGION VIII.
Accomplishment Plan, Region VIII. Red River of the North Basin.
W79-05722 5G

ENVIRONMENTAL PROTECTION AGENCY, EDISON, NJ. SURVEILLANCE AND ANALYSIS DIV.
Sources and Fates of Aromatic Compounds in Urban Stormwater Runoff,
W79-05627 5A

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. PERMIT PROGRAM DIV.
Implementation of Section 316 of the Federal Water Pollution Control Act,
W79-05755 5C

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. WATER PLANNING DIV.
Nonpoint Source Control Guidance, Agricultural Activities,
W79-05811 5G

ENVIRONMENTAL RESEARCH LAB., NARRAGANSETT, RI.
The Impact of Pollution on Marine Bathing Beaches: An Epidemiological Study,
W79-05712 5C

ESB, INC., YARDLEY, PA.
Investigation and Development of an Electrolytic System for the Conversion of Saline and Brackish Waters,
W79-05579 3A

FERGUSON (H. K.) CO., NEW YORK.
Vapor Compression with Secondary Heat-Transfer Media.
W79-05873 3A

FISH AND WILDLIFE SERVICE, ANCHORAGE, AK. OFFICE OF BIOLOGICAL SERVICES AND COASTAL ECOSYSTEMS.
Distribution and Abundance of Marine Birds - South and East Kodiak Island Waters,
W79-05889 5C

Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Southern Bering Sea,
W79-05893 5C

Avifaunal Assessment of Nelson Lagoon, Port Moller, and Herendeen Bay, Alaska - 1977,
W79-05894 5C

Breeding and Population Ecology of Fulmars at Semidi Islands, Alaska, with Observations on the Reproduction of Sympatric Seabird Species,
W79-05895 5C

Studies of Marine Birds on Ugaiushak Island,
W79-05896 5C

The Breeding Biology and Feeding Ecology of Marine Birds in the Sitkalidak Strait Area, Kodiak Island, 1977,
W79-05897 5C

The Breeding Biology of Marine Birds Associated with Chiniak Bay, Kodiak Island, 1977,
W79-05898 5C

Dynamics of Marine Bird Populations on the Barren Islands, Alaska,
W79-05899 5C

Community Structure of Seabirds of Wooded Island, Alaska,
W79-05900 5C

The Feeding Ecology and Trophic Relationships of Key Species of Marine Birds in the Kodiak Island Area, May-September 1977,
W79-05901 5C

Catalog of Alaskan Seabird Colonies,
W79-05902 5C

Survey of Beached Marine Birds in Alaska,
W79-05903 5C

FISH AND WILDLIFE SERVICE, ANCHORAGE, AK. OFFICE OF BIOLOGICAL SERVICES; AND NATIONAL MARINE FISHERIES SERVICES, SEATTLE, WA.
A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity - Their Numbers and Seasonal Movements,
W79-05674 5C

FLEET WEATHER FACILITY, SUITLAND, MD.
Eastern-Western Arctic Sea Ice Analyses,
W79-05613 2C

FLORIDA STATE UNIV., TALLAHASSEE. DEPT. OF OCEANOGRAPHY; AND FLORIDA STATE UNIV., TALLAHASSEE. FLORIDA RESOURCES AND ENVIRONMENTAL ANALYSIS CENTER.
Detection of Heavy Metal Pollution in Estuarine Sediments,
W79-05850 5B

FLORIDA UNIV., GAINESVILLE.
Subsurface Drainage Model with Associated Sediment Transport,
W79-05802 2J

FLORIDA UNIV., GAINESVILLE. DEPT. OF AGRICULTURAL ENGINEERING.
Effluent Irrigation of Coastal Bermuda Grass,
W79-05624 3C

FMC CORP., SANTA CLARA, CA.
Research on Vapor Reheat and Liquid-Liquid Heat Exchange,
W79-05574 3A

FOOD AND DRUG ADMINISTRATION, DAVISVILLE, RI. SHELLFISH SANITATION BRANCH.
Safe Shellfish from the Sea,
W79-05713 5C

FRANKLIN RESEARCH CENTER, PHILADELPHIA, PA.
Producing Selectively Infrared-Reflecting Surfaces on Plastic Films for Solar Stills,
W79-05659 3A

FRESHWATER FISHERIES LAB., PITLOCHRY (SCOTLAND).
The Occurrence of Organochlorine Residues in Rainwater,
W79-05848 5A

GENERAL ELECTRIC CO., BURLINGTON, VT.
Evaluation of a Thin-Film Sea Water Distillation Unit for Marine and Shore Base Application.
W79-05874 3A

GEOLOGICAL SURVEY, ALBANY, NY. WATER RESOURCES DIV.
Ground-Water Data on the Hudson River Basin, New York,
W79-05591 2F

Estuarine Research: An Annotated Bibliography of Selected Literature, With Emphasis on the Hudson River Estuary, New York and New Jersey,
W79-05593 2L

Selected Low-Flow Characteristics of Streams in the Vicinity of Warwick, Orange County, New York,
W79-05595 2E

Dye-Dispersion Study at Proposed Pumped-Storage Project on Hudson River at Cornwall-on-the-Hudson, New York,
W79-05596 5B

Installation of Water- and Gas-Sampling Wells in Low-Level Radioactive-Waste Burial Trenches, West Valley, New York,
W79-05970 5B

EOLOGICAL SURVEY CHEYENNE, WY. ATER RESOURCES DIV.

Water Resources Data for Wyoming, Water Year 1977--Volume 1. Missouri River Basin,
W79-05598 7C

Water Resources Data for Wyoming, Water Year 1977--Volume 2. Green River Basin, Bear River Basin, Snake River Basin,
W79-05599 7C

EOLOGICAL SURVEY, CONCORD, NH. ATER RESOURCES DIV.

Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire,
W79-05968 7C

EOLOGICAL SURVEY, DENVER, CO. EOLOGIC DIV.

Remote-Sensing and Subsurface Definition of Facies and Structure Related to Uranium Deposits, Powder River Basin, Wyoming,
W79-05977 7B

EOLOGICAL SURVEY, DENVER, CO. EOLOGICAL DIV.

Concentrations of Metals in Very Small Volumes of Soil Solution,
W79-05976 7B

EOLOGICAL SURVEY, DORAVILLE, GA. ATER RESOURCES DIV.

Ground-Water Levels and Quality Data for Georgia, 1977,
W79-05607 4B

EOLOGICAL SURVEY, HARTFORD, CT. ATER RESOURCES DIV.

Map Showing Drainage Areas, Columbia Quadrangle, Connecticut,
W79-05600 7C

Map Showing Drainage Areas, Norfolk Quadrangle, Connecticut,
W79-05601 7C

Map Showing Drainage Areas, New Britain Quadrangle, Connecticut,
W79-05602 7C

Map Showing Drainage Areas, Collinsville Quadrangle, Connecticut,
W79-05603 7C

EOLOGICAL SURVEY, IOWA CITY, IA. ATER RESOURCES DIV.

Water Resources of South-Central Iowa,
W79-05609 7C

GEOLOGICAL SURVEY, JACKSON, MS. WATER RESOURCES DIV.

The Mississippi River Valley Alluvial Aquifer in Mississippi,
W79-05597 7C

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.

Hydrologic Data for Water-Table Aquifers in the Boulder--Fort Collins--Greeley Area, Front Range Urban Corridor, Colorado,
W79-05594 7C

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Crested Butte Coal Field, Gunnison County, Colorado,
W79-05975 6D

Reconnaissance Evaluation of Water Resources for Hydraulic Coal Mining, Grand Hogback Coal Field, Garfield and Rio Blanco Counties, Colorado,
W79-05987 6D

GEOLOGICAL SURVEY, LANSING, MI. WATER RESOURCES DIV.

Water Supply Potential of the Lake Sally System, Marquette County, Michigan,
W79-05988 6D

GEOLOGICAL SURVEY, LAWRENCE, KS. WATER RESOURCES DIV.

Water Resources Data for Kansas, Water Year 1978,
W79-05989 7C

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.

Ground-Water Data for 1976-77 in Joshua Tree National Monument, California,
W79-05982 2F

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.; AND GEOLOGICAL SURVEY, MENLO PARK, CA. CONSERVATION DIV.

Benthic Invertebrates in a North-Flowing Stream and a South-Flowing Stream, Brooks Range, Alaska,
W79-05965 2A

GEOLOGICAL SURVEY, NASHVILLE, TN. WATER RESOURCES DIV.

Water Resources of the Upper Duck River Basin, Central Tennessee,
W79-05985 6D

GEOLOGICAL SURVEY, NSTL STATION, MS. WATER RESOURCES DIV.

A Summary of Measured Hydraulic Data for the Series of Steady and Unsteady Flow Experiments Over Uniform Grass Roughness,
W79-05966 2E

Modeling Nitrogen, Oxygen, Chattahoochee River, GA.,
W79-05974 5B

GEOLOGICAL SURVEY, OKALHOMA CITY, OK. WATER RESOURCES DIV.; AND OKLAHOMA WATER RESOURCES BOARD, OKLAHOMA CITY.

Selected Water-Level Records for Oklahoma, 1975-1977,
W79-05604 2F

GEOLOGICAL SURVEY, OKLAHOMA CITY, OK. WATER RESOURCES DIV.

Application of Hydraulic and Hydrologic Data in Urban Stormwater Management,
W79-05588 6A

Hydrologic Data for the Antlers Aquifer, Southeastern Oklahoma,
W79-05590 2A

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.

Proceedings of the First Membership Conference of the National Water Data Exchange, May 9-11, 1978, Denver, Colorado,
W79-05585 7C

National Water Data Coordination in the United States,
W79-05971 7A

Sediment Management Concepts in Urban Storm Water System Design,
W79-05981 4A

GEOLOGICAL SURVEY, RICHMOND, VA. WATER RESOURCES DIV.

Flood-Plain Delineation for Occoquan River, Wolf Run, Sandy Run, Elk Horn Run, Giles Run, Kanes Creek, Racoon Creek, and Thompson Creek, Fairfax County, Virginia,
W79-05986 6A

GEOLOGICAL SURVEY, SALT LAKE CITY, UT. WATER RESOURCES DIV.

Ground-Water Resources of the Parowan-Cedar City Drainage Basin, Iron County, Utah,
W79-05608 2F

GEOLOGICAL SURVEY, SAN JUAN, PR. WATER RESOURCES DIV.

Summary of the Water Resources of Puerto Rico,
W79-05592 6D

Chemical, Physical, Biochemical, and Bacteriological Characteristics at Selected Stream Sites in Puerto Rico, 1967-77,
W79-05967 7A

GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.

Physiography and Surficial Geology of the Copper-Nickel Study Region, Northeastern Minnesota,
W79-05984 7C

GEOLOGICAL SURVEY, SYOSSET, NY. WATER RESOURCES DIV.

Monthly Fluctuations in the Quality of Ground Water Near the Water Table in Nassau and Suffolk Counties, Long Island, New York,
W79-05587 5B

GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.

Flight Path Curvature Distortion in Side-Looking Airborne Radar Imagery,
W79-05973 7B

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.

Water-Supply Potential of the Lower Hillsborough River, Florida, 1976,
W79-05586 4A

Quality of the Water in Borrow Ponds Near a Major Highway Interchange, Dade County, Florida, October-November 1977,
W79-05589 5B

Geologic and Geophysical Data from Osceola National Forest, Florida,
W79-05605 5A

Record of Wells in the Floridan Aquifer in Dade and Monroe Counties, Florida,
W79-05606 7C

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.

Ground-Water Quality Near the Northwest 58th Street Solid-Waste Disposal Facility, Dade County, Florida,
W79-05972 5B

Effects of Land Use and Water Management on Water Quality in the Western South New River Canal Basin, Southeast Florida, 1974-75,
W79-05978 4C

GEOLOGICAL SURVEY, TAMPA, FL. WATER RESOURCES DIV.

Potentiometric Surface of Floridan Aquifer, Southwest Florida Water Management District and Adjacent Areas, September 1978,
W79-05983 7C

GILBERT/COMMONWEALTH, READING, PA.

Perils of the Orderly Mind: Cost-Benefit Analysis and Other Logical Pitfalls,
W79-05751 6B

GRACE (W.R.) AND CO., CLARKSVILLE, MD. RESEARCH DIV.

Removal of Scale-Forming Compounds from Sea Water,
W79-05578 3A

GROUND-WATER QUALITY CONSULTANT, FRESNO, CA.

Evaluation of Proposed TG and E (Tucson Gas and Electric Company) Wastewater Discharge on Groundwater in the Tucson Basin,
W79-05519 5E

GULF SOUTH RESEARCH INST., NEW ORLEANS, LA.

Study of Oriented Cellulose Membranes for Reverse Osmosis and the Relationship Between Morphology and Salt Rejection,
W79-05879 3A

HARMONY EMITTER CO., INC., TUCSON, AZ. (ASSIGNEE).

Casing Mounted Emitter,
W79-05953 3F

HARZA ENGINEERING CO., CHICAGO, IL.

Economic Impact of Proposed Amendments to Water Pollution Regulations, R77-12, Docket A.
W79-05753 6E

HAWAII UNIV., HONOLULU. DEPT. OF OCEAN ENGINEERING.

Long Wave Model Independent of Stability Criteria,
W79-05534 2L

HYDROSCIENCE, INC., WESTWOOD, NJ.

Stormwater Interception and Storage,
W79-05625 2E

ICHTHYOLOGICAL ASSOCIATES, INC., FORKED RIVER, NJ.

Survival of Fishes and Macroinvertebrates Impinged at Oyster Creek Generating Station,
W79-05773 5C

ICHTHYOLOGICAL ASSOCIATES, INC., MIDDLETOWN, DE.

A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish,
W79-05788 8I

IDAHO AGRICULTURAL EXPERIMENT STATION, ABERDEEN.

Erosion Control/Sediment Modeling--Southern Idaho a Progress Report,
W79-05804 2J

IDAHO UNIV., ABERDEEN.

Rapidly Obtaining Optimal Irrigation System Designs,
W79-05993 3F

IFO SANITAR A. B., BROMOLIA (SWEDEN). (ASSIGNEE).

Method and Apparatus for Removing Filterable Substances from a Liquid,
W79-05955 5D

ILLINOIS INST. FOR ENVIRONMENTAL QUALITY, CHICAGO.

Technology and Economics of Industrial Pollution Abatement,
W79-05865 5B

ILLINOIS STATE WATER SURVEY, URBANA.

Assessment of Weather Modification in Alleviating Agricultural Water Shortages During Droughts,
W79-05836 2B

INSTITUTE FOR APPLIED RESEARCH ON NATIONAL RESOURCES, BAGHDAD (IRAQ).

Maximum Rainfall Intensity in Different Period Intervals in Iraq,
W79-05571 2B

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).

An Analytical Model of Rainfall Interception by Forests,
W79-05854 2D

The Effect of the Small-Slope Approximation and Lower Boundary Conditions on Solutions of the Saint-Venant Equations,
W79-05938 2E

INSTITUTE OF METEOROLOGY AND WATER MANAGEMENT, KRACOW (POLAND).

Removal of Color, Detergents, and Other Refractory Substances from Textile Wastewater,
W79-05867 5D

INSTITUTE OF TROPICAL METEOROLOGY, POONA (INDIA).

Computation of the Average Precipitation Over the Western Part of Peninsular India During the Summer Monsoon From the Continuity Equation for Atmospheric Water Vapour,
W79-05619 2B

INTERNATIONAL INST. OF TROPICAL AGRICULTURE IBADAN (NIGERIA).

Concentration and Size of Gravel in Relation to Neutron Moisture and Density Probe Calibration,
W79-05530 7B

INTERNATIONAL LIVESTOCK CENTRE FOR AFRICA, ADDIS ABABA (ETHIOPIA).

Biological Recovery Versus Desertization,
W79-05556 3B

INTERNATIONAL RICE RESEARCH INST., LOS BANOS, LAGUNA (PHILIPPINES). DEPT. OF AGRONOMY.

Ammonia Volatilization Losses from Flooded Rice Soils,
W79-05812 2K

INTERSTATE SANITATION COMMISSION, NEW YORK.

Acid Precipitation in the New York Metropolitan Area: Its Relationship to Meteorological Factors,
W79-05626 2K

IONICS INC., CAMBRIDGE, MA.

Investigation of Supersaturation in Saline Water Conversion,
W79-05872 3A

IONICS, INC., WATERTOWN, MA.

Design, Construction, Field Testing and Cost Analysis of an Experimental Electrodialysis Demineralizer for Brackish Waters,
W79-05651 3A

IOWA STATE UNIV., AMES. DEPT. OF AGRICULTURAL ENGINEERING.

Conservation and Conventional Systems for Continuous Production of Corn,
W79-05820 3F

IOWA STATE UNIV., AMES. ENERGY AND MINERAL RESOURCES RESEARCH INST.

Surface Water Quality Associated with the Surface Mining of Iowa Coal,
W79-05834 5E

IRRIGATION SPECIALTIES CO., SAN GABRIEL, CA. (ASSIGNEE).

Dual-Function Valve,
W79-05959 3F

JEFFERSON COUNTY HEALTH DEPARTMENT, LAKEWOOD, CO.; AND COLORADO UNIV., DENVER. SCHOOL OF MEDICINE.

Disposal of a Large Quantity of Sodium Fluoroacetate in a Sanitary Landfill Site Located in a Aquifer Recharging Area,
W79-05835 5C

JOHN HOPKINS UNIV., BALTIMORE, MD. DEPT. OF PATHOBIOLOGY.

Effects of Petroleum Exposure on the Breeding Ecology of the Gulf of Alaska Herring Gull Group and Reproductive Ecology of Large Gulls in the Northeast Gulf of Alaska,
W79-05923 5C

JOHNS HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.

Man's Impact on the Middle Atlantic Continental Shelf and the New York Bight--Symposium Summary,
W79-05679 5

Sources of Urban Wastes,
W79-05689 5

JORDAN CO. INC., PORTLAND, ME.

Sludge-Dewatering Techniques Must Meet Pollution Control Requirements,
W79-05506 5

KEARNEY STATE COLL., NE.

Comparison of Evapotranspiration Rates in the Platte River in Nebraska: 1938 vs 1978,
W79-05798 2

KENTUCKY WATER RESOURCES RESEARCH INST., LEXINGTON.

Design of a Reliable, Inexpensive Recording Rain Gage Which Utilizes Solid-State Memory,
W79-05793 7

LA JOLLA, CA. SCRIPPS INSTITUTION OF OCEANOGRAPHY.

Effects of Oiling on Temperature Regulation in Sea Otters,
W79-05921 5

LABORATOIRE DE CHIMIE INORGANIQUE ET NUCLEAIRE, CHEMIN DU CYCLOTRON LOUVAIN (BELGIUM).

An Automatic Sequential Rain Sampler,
W79-05847 7

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY.
New York Bight Water Stratification--October 1974,
W79-05682 1A

Suspended Particulate Concentrations and Compositions in the New York Bight,
W79-05687 5C

LAPORTE INDUSTRIES LTD., LONDON (ENGLAND). (ASSIGNEE).
Water Treatment,
W79-05948 5D

LAWLER, MATUSKY AND SKELLY, PEARL RIVER, NY.
Models Useful for the Estimation of Equilibrium Population Reduction Due to Power Plant Cropping,
W79-05764 5C

LAWLER, MATUSKY & SKELLY, PEARL RIVER, NY.
Possibilities for Assessment of the Effects of Power Plant Operation at the Ecosystem Level,
W79-05780 5C

LEBOEUF, LAMB, LEIBY AND MACRAE, NEW YORK.
The Role of the Scientist in the Section 316 Process: A Lawyer's Point of View,
W79-05758 5C

LEHIGH UNIV., BETHLEHEM, PA.
Storm Water Management for Little Lehigh and Cedar Creek Drainage Basins,
W79-05721 4A

LGL LTD., EDMONTON (ALBERTA).
Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Avian Ecology in Simpson Lagoon, 1977,
W79-05928 5C

Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Invertebrates in Simpson Lagoon, 1977,
W79-05930 5C

LGL LTD., NANAIMO (BRITISH COLUMBIA).
Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Ecology of Fishes in Simpson Lagoon, 1977,
W79-05929 5C

LGL LTD.-U.S., INC. BRYAN, TX.
Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. Overview and Synthesis,
W79-05927 5C

LINDSAY MFG. CO., NE.
'Corner Pivot' An Effective Corner Watering System,
W79-05990 3F

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE (ENGLAND). DEPT. OF MEDICAL PROTOZOOLOGY.
The Relationship Between Economic Development and Ecological Degradation: How Degradation has Occurred in West Africa and How Its Progress Might be Halted,
W79-05565 6B

LOS ALAMOS SCIENTIFIC LAB., NM.
Hydrogeochemical and Stream Sediment Reconnaissance of the National Uranium Resource Evaluation Program, October-December 1976,
W79-05522 5A

LOUIS KOENIG - RESEARCH, SAN ANTONIO, TX.
Disposal of Saline Water Conversion Brines -- An Orientation Study,
W79-05657 3A

LOUISVILLE UNIV., KY. DEPT. OF BIOLOGY.
Assessment of Potential Interactions of Microorganisms and Pollutants Resulting from Petroleum Development on the Outer Continental Shelf of Alaska,
W79-05914 5C

MAINE DEPT. OF ENVIRONMENTAL PROTECTION, AUGUSTA. BUREAU OF WATER QUALITY CONTROL.
Quality of Selected Waters in Southern Maine.
W79-05832 5B

MAINE UNIV. AT ORONO. INST. FOR QUATERNARY STUDIES.
Effect of Climatic Warming on the West Antarctic Ice Sheet,
W79-05528 2C

MAINE UNIV., WALPOLE. IRA C. DARLING CENTER FOR RESEARCH TEACHING AND SERVICE.
Mortalities of the Larvae of Two Species of Bivalves after Acute Exposure to Elevated Temperature,
W79-05771 5C

MANHATTAN COLL., BRONX, NY. DEPT. OF ENVIRONMENTAL ENGINEERING AND SCIENCE.
Contaminants Entering the New York Bight: Sources, Mass Loads, Significance,
W79-05690 5B

MARYLAND UNIV., COLLEGE PARK. DEPT. OF CIVIL ENGINEERING.
Classification of Evaluation of Flood Flow Frequency Estimation Techniques,
W79-05844 2E

MARYLAND UNIV., COLLEGE PARK. DEPT. OF MICROBIOLOGY.
Microbiological Studies of the Atlantic Continental Shelf,
W79-05698 5C

MARYLAND UNIV., COLLEGE PARK. WATER RESOURCES RESEARCH CENTER.
Feasibility Study for Development of a Transient Three-Dimensional Groundwater Flow Model Utilizing the Finite Element Method,
W79-05799 2F

Adsorption of Virus on Activated Carbon Under Varying Water Chemistry Conditions,
W79-05831 5D

MASON-RUST, WEBSTER, SD.
Saline Water Conversion Demonstration Plant, Webster, South Dakota: First Annual Report,
W79-05577 3A

METCALF AND EDDY, INC., PALO ALTO, CA.
Urban Stormwater Management and Technology: Update and User's Guide,
W79-05725 5G

METEOROLOGICAL OFFICE, NEW DELHI (INDIA).
A Statistical Study of the Annual Rainfall in the Sutlej Catchment and Annual Run-Off at Bhakra Dam Site,
W79-05628 2B

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, IL. RESEARCH AND DEVELOPMENT LAB.
Zinc and Cadmium Contents of Agricultural Soils and Corn in Northwestern Indiana,
W79-05947 5B

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS, WASHINGTON, DC.
A Demonstration of Area Wide Water Resources Planning,
W79-05714 6A

A Demonstration of Areawide Water Resources Planning--Users Manual,
W79-05715 6A

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF GEOLOGY.
Evaluation of Groundwater Flow and Recharge Through Glacial Drift, Michigan State Water Quality Management Project, East Lansing, Michigan,
W79-05791 4B

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF MICROBIOLOGY.
Kinetic Parameters of the Conversion of Methane Precursors to Methane in a Hypereutrophic Lake Sediment,
W79-05508 5C

MICHIGAN UNIV., ANN ARBOR. DEPT. OF RESOURCES ECONOMICS.
Pricing Irrigation Water in Mexico: Efficiency, Equity and Revenue Considerations,
W79-05566 6C

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.
Effects of the Donald C. Cook Nuclear Power Plant on Zooplankton of Southeastern Lake Michigan,
W79-05766 5C

MINNESOTA UNIV., ST. PAUL. DEPT. OF AGRICULTURAL ENGINEERING.
Effects of Drainage Projects on Runoff from Depressional Watersheds,
W79-05979 4A

MISSOURI UNIV., COLUMBIA. DEPT. OF AGRONOMY.
Effect of Environmental Factors on Survival of Salmonella Typhimurium in Soil,
W79-05807 5B

MISSOURI UNIV., COLUMBIA, DEPT. OF CIVIL ENGINEERING.
Supercritical Flow in Bends of Trapezoidal Section,
W79-05531 2E

MONTCLAIR STATE COLL., UPPER MONTCLAIR, NJ. DEPT. OF BIOLOGY.
Antimicrobial Resistant Bacteria in the New York Bight,
W79-05708 5C

NALCO ENVIRONMENTAL SCIENCES, LINCOLN, NE.
Entrainment of Missouri River Fish Larvae Through Fort Calhoun Station,
W79-05760 5C

Entrainment of Crustacean Zooplankton Through Fort Calhoun Station,
W79-05767 5C

Macroinvertebrate Entrainment Study at Fort Calhoun Station,
W79-05768 5C

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.
Estimation of Snow Temperature and Mean Crystal Radius From Remote Multispectral Passive Microwave Measurements,
W79-05518 2C

The Use of Snowcovered Area in Runoff Forecasts,
W79-05611 2C

Dielectric Constants of Soils at Microwave Frequencies--II,
W79-05861 2G

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, HOUSTON, TX. LYNDON B. JOHNSON SPACE CENTER.
Proceedings for Gathering Ground Truth Information for a Supervised Approach to a Computer-Implemented Land Cover Classification of Landsat-Acquired Multispectral Scanner Data,
W79-05859 7B

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, LANGLEY STATION, VA. LANGLEY RESEARCH CENTER.
Quantitative Analysis of Aircraft Multispectral-Scanner Data and Mapping of Water-Quality Parameters in the James River in Virginia,
W79-05862 7B

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH, BOULDER, CO.
A Large-Scale Numerical Model of Sea Ice,
W79-05632 2C

NATIONAL MARINE FISHERIES SERVICE, AUKE BAY, AK. NORTHWEST AND ALASKA FISHERIES CENTER.
Baseline/Reconnaissance Characterization Littoral Biota, Gulf of Alaska and Bering Sea,
W79-05907 5C

NATIONAL MARINE FISHERIES SERVICE, BEAUFORT, NC. BEAUFORT LAB.
Distribution of Suspended Bacteria in the Newport River Estuary, North Carolina,
W79-05623 2L

Effects of Acute Thermal Stress on Marine Fish Embryos and Larvae,
W79-05769 5C

NATIONAL MARINE FISHERIES SERVICE, HIGHLANDS, NJ. MIDDLE ATLANTIC COASTAL FISHERIES CENTER.
Effects of Coastal Pollution on Fish and Fisheries--With Particular Reference to the Middle Atlantic Bight,
W79-05699 5C

Seabed Oxygen Consumption--New York Bight Apex,
W79-05705 5C

Temporal and Spatial Distributions of Benthic Macroinvertebrates in the New York Bight,
W79-05709 5C

NATIONAL MARINE FISHERIES SERVICE, MILFORD, CT. EXPERIMENTAL BIOLOGICAL INVESTIGATIONS.
Chromosome Mutagenesis in Developing Mackerel Eggs Sampled from the New York Bight,
W79-05703 5C

NATIONAL MARINE FISHERIES SERVICE, OXFORD, MD. MIDDLE ATLANTIC COASTAL FISHERIES CENTER.
Fin Rot Disease Studies in the New York Bight,
W79-05702 5C

Infectious Diseases in Commercial Shellfish on the Middle Atlantic Coast,
W79-05711 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA.
Major Passage Problems,
W79-05509 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWEST AND ALASKA FISHERIES CENTER.
Baseline Characterization of Marine Mammals in the Bering Sea: Distribution and Abundance,
W79-05665 5C

Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska,
W79-05666 5C

Seasonal Distribution and Abundance of Bowhead and Beluga Whales in the Bering Sea and Arctic Ocean,
W79-05667 5C

Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea,
W79-05916 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWEST FISHERIES CENTER.
Ocean-Atmosphere Interactions Off the Northeast Coast of North America,
W79-05681 5B

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWESTERN AND ALASKA FISHERIES CENTER.
Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Biotransformations, as Reflected by Morphological, Chemical, Physiological, Pathological and Behavioral Indices,
W79-05922 5C

NATIONAL MARINE FISHERIES SERVICE, WOODS HOLE, MA. NORTHEAST FISHERIES CENTER.
Middle Atlantic Fisheries: Recent Changes in Populations and Outlook,
W79-05700 5C

Some Results of Fish Surveys in the Mid-Atlantic Important For Assessing Environmental Impacts,
W79-05701 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MI. GREAT LAKES ENVIRONMENTAL RESEARCH LAB.
A Three-Dimensional Model of Lake Ontario's Summer Circulation, II. A Diagnostic Study,
W79-05635 2H

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABS.
Morphologic Evolution and Coastal Sand Transport, New York--New Jersey Shelf,
W79-05684 2J

Trace Metals in the New York Bight,
W79-05691 5B

Oxygen Depletion in the New York Bight Apex: Causes and Consequences,
W79-05694 5B

Carbohydrates and Organic Carbon in New York Bight Sediments as Possible Indicators o Sewage Contamination,
W79-05695 5E

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABS.; AND ADELPHI UNIV., GARDEN CITY, NY.
Surficial Sediments of the NOAA-MESA Study Areas in the New York Bight,
W79-05685 5E

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ROCKVILLE, MD. ENVIRONMENTAL SCIENCE INFORMATION CENTER.
Lake Erie Ice: Winter 1975-76,
W79-05615 2C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SEATTLE, WA. PACIFIC MARINE ENVIRONMENTAL LAB.
Effects of Hindered Settling on Sediment Concentration Profiles,
W79-05542 2

Composition and Source Identification of Organic Detritus in Lower Cook Inlet,
W79-05925 5

NATIONAL POWER PLANT TEAM, ANN ARBOR, MI.
Entrainment Impact Estimates Using the Equivalent Adult Approach,
W79-05516 5

NATIONAL TAIWAN UNIV., TAIPEI. DEPT. OF CIVIL ENGINEERING.
Subsidence of Peak Flow in Channels with Storage Areas,
W79-05541 2

NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VA.
Groundwater Pollution. Part 2. Pollution from Irrigation and Fertilization. Vol. 2. 1977-January, 1978. (Citations from the NTIS Data Base
W79-05826 5

NATIONAL WATER AUTHORITY, BUDAPEST (HUNGARY). DEPT. OF WATER RESOURCES DEVELOPMENT.
Hydrology and Water Control on Large Plain
W79-05526 2

NATIONAL WEATHER SERVICE, SILVER SPRING, MD. OFFICE OF HYDROLOGY.
Probable Maximum Precipitation Estimates United States East of the 105th Meridian,
W79-05863

NATIONAL WEATHER SERVICE, SILVER SPRING, MD. TECHNIQUES DEVELOPMENT LAB.
Analysis of Cool Season Lake-Related Mesoscale Phenomena Using Numerical Variation Analysis,
W79-05523

NAVAL FACILITIES ENGINEERING COMMAND, WASHINGTON, DC. CHESAPEAKE DIV.
Wave Forces on Cylinders Near Plane Boundaries,
W79-05532

NEBRASKA UNIV., NORTH PLATTE. DEPT OF AGRICULTURAL ENGINEERING.
Corn Yields from Irrigation with Adequate Deficient Water,
W79-05803

EDERLANDS INST. VOOR ONDERZOEK ER ZEE, TEXEL.
Biomass and Species Richness of the Macrobenthic Animals Living on the Tidal Flats of the Dutch Wadden Sea: Long-Term Changes During a Period with Mild Winters,
W79-05718 5C

ELSON (L. R.) CORP., PEORIA, IL. ASSIGNEE).
Adjustable Bubbler Sprinkler Head,
W79-05960 3F

IEW ENGLAND RIVER BASINS OMMISSION, BOSTON, MA.
Selected Priorities: 1978-82--A First-Year Effort Recommending Priorities for Selected Federal Water and Related Land Resource Programs in New England.
W79-05724 6E

IEW HAMPSHIRE UNIV., DURHAM. DEPT. OF BOTANY AND PLANT PATHOLOGY.
Ecological Studies of the Annual Red Alga Dumontia Ncrassata (O.F. Muller) Lamouroux,
W79-05618 5C

IEW SOUTH WALES UNIV., KENSINGTON AUSTRALIA). WATER RESEARCH LAB.
Two-Dimensional Bubble Plumes,
W79-05539 8B

NORGES VASSDRAGS- OG ELEKTRISITETSVENSEN, OSLO.
Application of LANDSAT Imagery for Snow Mapping in Norway,
W79-05617 7B

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF BIOLOGICAL AND AGRICULTURAL ENGINEERING.
Monitoring Areawide Rural Water Quality,
W79-05842 5A

North Carolina 208 Case Study,
W79-05969 6E

NORTHWESTERN UNIV. EVANSTON, IL. DEPT. OF CIVIL ENGINEERING.
Granular Media Filtration of Dredging Effluents,
W79-05621 5A

NOTTINGHAM UNIV. (ENGLAND). SCHOOL OF AGRICULTURE.
Dew and Thermal Lag: A Model for Cocoa Pods,
W79-05856 2B

NUCLEAR RESEARCH INST., BAGHDAD (IRAQ); MIDDLE EASTERN REGIONAL RADIOISOTOPE CENTRE FOR THE ARAB COUNTRIES, CAIRO (EGYPT).
Tritium Dating of Some Groundwater Samples from Northwestern Iraqi Desert,
W79-05569 2F

NUCLEAR SUPREME, CASPER, WY. (ASSIGNEE).
Sewage Treating and Conversion Process,
W79-05962 5D

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
An Analysis of Factors Influencing the Impingement of Threadfin Shad at Power Plants in the Southeastern United States,
W79-05774 5C

Temporally Stratified Sampling Programs for Estimation of Fish Impingement,
W79-05777 5C

Walker Branch Watershed: Site Description and Research Scope,
W79-05837 2A

OBSERVATORY, NEW DELHI (INDIA).
A Study of Large Floods in the Thambraparani River in Tamil Nadu,
W79-05629 2E

OCEANIC INST., WAIMANALO, HI.
The Culture of the Diatom Chaetoceros Gracilis and Its Use as a Food for Penaeid Protozoeal Larvae,
W79-05738 5C

OFFICE OF TECHNOLOGY ASSESSMENT, WASHINGTON, DC.
Water and Energy in the Western Coal Lands,
W79-05845 6D

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRICULTURAL ENGINEERING.
Performance of Center-Pivot Sprinkler Irrigation Systems Operating at Reduced Pressures,
W79-05997 3F

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRONOMY.
Water Relations of Cadmium-Treated Plants,
W79-05934 2I

OKLAHOMA UNIV., NORMAN.
Theoretical Studies of the Behavior of Ions in Aqueous Solutions of Mixed Electrolytes with Respect to Osmionic Operation,
W79-05647 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Carbon Electrodes,
W79-05649 3A

Demineralization of Saline Water by Electrically-Induced Adsorption on Porous Graphite Electrodes.
W79-05661 3A

OREGON STATE UNIV., CORVALLIS.
Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation,
W79-05885 5C

OREGON STATE UNIV., CORVALLIS. DEPT. OF GEOGRAPHY.
Center Pivot Irrigation in the Columbia Basin of Washington and Oregon: Dynamics and Implications,
W79-05818 3F

OREGON STATE UNIV., CORVALLIS. DEPT. OF MICROBIOLOGY.
Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea,
W79-05915 5C

OREGON STATE UNIV., CORVALLIS. DEPT. OF SOIL SCIENCE; AND OREGON STATE UNIV., CORVALLIS. DEPT. OF MICROBIOLOGY.
Transport of Antibiotic-Resistant Escherichia Coli Through Western Oregon Hillslope Soils Under Conditions of Saturated Flow,
W79-05932 5B

OREGON STATE UNIV., CORVALLIS. SCHOOL OF OCEANOGRAPHY.
The Distribution, Abundance, Diversity and Productivity of the Western Beaufort Sea Benthos,
W79-05906 5C

OXFORD UNIV. (ENGLAND).
Arid Geomorphology,
W79-05558 2J

OXFORD UNIV. (ENGLAND). SCHOOL OF GEOGRAPHY.
Dust Storms and Their Geomorphological Implications,
W79-05559 2J

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, COLLEGE, AK. ALASKA REGION.
The Suspended Sediment Regime of an Oregon Coast Range Stream,
W79-05846 2J

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, WENATCHEE, WA. FOREST HYDROLOGY LAB.
Stream Chemistry and Watershed Nutrient Economy Following Wildfire and Fertilization in Eastern Washington,
W79-05824 5B

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRICULTURAL ENGINEERING.
Computer Model for Center Pivot Sprinkler Design,
W79-05994 3F

PENNSYLVANIA UNIV., PHILADELPHIA.
The Study of Ionic Solvation,
W79-05658 1A

PITTSBURGH, UNIV., PA.
Bibliography of Publications on Compounds of Gas Hydrate Type,
W79-05572 10C

POINT REYES BIRD OBSERVATORY, STINSON BEACH, CA.
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. I: Breeding Bird Use of Barrier Islands in the Northern Chukchi and Beaufort Seas,
W79-05676 5C

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska. II: Feeding Habits of Birds in the Beaufort Sea,
W79-05677 5C

The Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice,
W79-05887 5C

Influence of Petroleum on Egg Formation and Embryonic Development in Seabirds,
W79-05924 5C

POLISH ACADEMY OF SCIENCES, WARSAW LAB. OF ECOLOGICAL BIOENERGETICS.
Ecological Bioenergetics of Physa Acuta (Gastropoda) in Heated Waters,
W79-05514 5C

POLITECNICO DI MILANO, MILAN (ITALY).
Parameter Estimation of Streeter-Phelps Models,
W79-05841 5B

POLYTECHNIC INST. OF NEW YORK, BROOKLYN. DIV. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Multifarious Power Plant Water Intake Structure: A Design to Reduce Impingement and Entrainment Mortality,
W79-05786 8I

PRENGLE, DUKLER AND CRUMP, INC., HOUSTON, TX.
Heat Transfer in the LTV Evaporator: An Analysis of Pilot Plant Data and Predictive Techniques for Plant Operation and Design,
W79-05581 3A

PUBLIC POWER CORP., ATHENS(GREECE). COMPUTING CENTER.
Flow Profiles in Trapezoidal Channels by Pocket Calculators,
W79-05538 8B

PURDUE UNIVERSITY WATER RESOURCES RESEARCH CENTER, WEST LAFAYETTE, INDIANA.
Chemistry of Phosphorus, Cadmium, Copper, Nickel, Lead, and Zinc in Indiana Lake and Reservoir Sediments,
W79-05794 5B

RAINBIRD TECHNICAL SERVICES, LOGAN, UT.
Variability of Sprinkler Coefficient of Uniformity Test Results,
W79-05805 3F

READING UNIV. (ENGLAND). DEPT. OF METEOROLOGY.
The Modeling of Tidal Flow in a Channel Using a Turbulence Energy Closure Scheme,
W79-05637 2L

REGIONAL SCIENCE RESEARCH INST., PHILADELPHIA, PA.
The Perception and Valuation of Water Quality: A Review of Research Method and Findings,
W79-05723 6B

REGIS COLL. RESEARCH CENTER, WESTON, MA.
Comparison of 2.8- and 21-Cm Microwave Radiometer Observations over Soils with Emission Model Calculations,
W79-05633 7B

RENEWABLE RESOURCES CONSULTING SERVICES, LTD. FAIRBANKS, AK.
Ecological Studies of Colonial Seabirds at Cape Thompson and Cape Lisburne, Alaska,
W79-05892 5C

RESIDUALS MANAGEMENT TECHNOLOGY INC., MADISON, WI.
Tough Environmental Requirements Demand New Approaches to Landfill,
W79-05505 5E

RESOURCE MANAGEMENT ASSOCIATES, LAFAYETTE, CA.; AND TETRA TECH, INC., LAFAYETTE, CA.
A Conceptual Representation of the New York Bight Ecosystem,
W79-05696 5B

RESOURCES RESEARCH INC., MCLEAN, VA.
Part I: Survey of Physiological Mechanisms of Sodium and Chloride Ion Transport and Design of Experiment for Application to Demineralizing Saline Waters - Part II: Laboratory Evaluation of Use of Algae in Saline Water Conversion -- Phase I Final Report,
W79-05648 3A

RHODE ISLAND UNIV., KINGSTON. DEPT. OF MATHEMATICS; AND RHODE ISLAND UNIV., KINGSTON. GRADUATE SCHOOL OF OCEANOGRAPHY.
Benthic Colonization Processes--A Review and a Proposed New Model,
W79-05707 5C

RHODE ISLAND UNIV., KINGSTON. GRADUATE SCHOOL OF OCEANOGRAPHY.
Cultivating and Harvesting Algae to Forestall Accelerated Eutrophication,
W79-05584 5C

ROYAL INST. OF TECH., STOCKHOLM (SWEDEN).
Local Infiltration of Storm Water,
W79-05550 4A

ROYAL SIGNALS AND RADAR ESTABLISHMENT, MALVERN (ENGLAND). RADAR RESEARCH LAB.
Persistence and Orographic Modulation of Mesoscale Precipitation Areas in a Potentially Unstable Warm Sector,
W79-05855 2B

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. DEPT. OF MICROBIOLOGY; AND RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. MARINE SCIENCES CENTER.
Bacterial Flux in Some New Jersey Estuarine Sediments,
W79-05704 2L

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. WATER RESOURCES RESEARCH INST.
Nonpoint Source Pollution,
W79-05582 5B

SASKATCHEWAN UNIV., SASKATOON. DEPT. OF SOIL SCIENCE.
The Uptake of 203Hg-Labeled Mercury Compounds by Bromegrass from Irrigated Undisturbed Soil Columns,
W79-05943 5B

Influence of the Chemical Form of Mercury on Its Adsorption and Ability to Leach Through Soils,
W79-05944 5B

SAURASHTRA UNIV., RAJKOT (INDIA). DEPT. OF BIOSCIENCES.
Eco-Biochemical Studies on Some Economically Important Intertidal Algae from Port Okha (India),
W79-05630 5C

Ecological Studies on the Intertidal Algae at Okha (India),
W79-05747 5C

SAVANNAH RIVER ECOLOGY LAB., AIKEN, SC.
Seasonal Cycling of Cesium-137 in a Reservoir,
W79-05622 5B

Growth and Elemental Composition of Corn and Bean Seedlings as Influenced by Soil Application of Coal Ash,
W79-05942 5B

SCIENCE AND EDUCATION ADMINISTRATION, BELTSVILLE. FRUIT LAB.
Extractability of Cadmium, Copper, Nickel, and Zinc by Double Acid Versus DTPA and Plant Content at Excessive Soil Levels,
W79-05946 5B

SCIENCE AND EDUCATION ADMINISTRATION, BELTSVILLE, MD. HYDROLOGY LAB.
Residue and Tillage Effects on SCS Runoff Curve Numbers,
W79-05980 2E

SCIENCE AND EDUCATION ADMINISTRATION, DENVER, CO. AQUATIC WEED CONTROL RESEARCH LAB.
Simazine Residue Levels in Irrigation Water After Ditchbank Application for Weed Control,
W79-05821 5B

SCIENCE AND EDUCATION ADMINISTRATION, KIMBERLY, ID. SNAKE RIVER CONSERVATION RESEARCH CENTER.
Redox Potentials in a Cropped Potato Processing Waste Water Disposal Field with a Deep Water Table,
W79-05822 5B

SCIENCE AND EDUCATION ADMINISTRATION, OXFORD, MS. SEDIMENTATION LAB.
Statistical Analysis of Concentration Records,
W79-05535 2J

SEWAGE OSMOSIS INCE., MINNEAPOLIS, MN. (ASSIGNEE).
Sewage Osmosis System,
W79-05950 5D

SIGMATRON, INC., SANTA BARBARA, CA.
Research on Condensation Mechanisms,
W79-05882 3A

SLOVENSKA AKADEMIJA ZNANOSTI IN UMETNOSTI, LJUBLIJANA (YUGOSLAVIA). BIOLOGICAL INST.
Salinity Dependent Distribution of Benthic Algae in Estuarine Areas of Icelandic Fjords,
W79-05745 5C

SOIL CONSERVATION SERVICE, WASHINGTON, DC. ENGINEERING DIV.
Earth Dams and Reservoirs,
W79-05612 2H

SOUTH DAKOTA STATE UNIV., BROOKINGS. WATER RESOURCES RESEARCH INST.
Analysis and Dissemination of Water Resources Information,
W79-05792 7C

SOUTHERN ILLINOIS UNIV. AT CARBONDALE. DEPT. OF BOTANY.
Isolation, Purification and Evidence for a Halophilic Nature of the Blue-Green Alga Aphanothece Halophytica Fremy (Chroococcales),
W79-05742 5C

SOUTHERN PIEDMONT CONSERVATION RESEARCH CENTER, WALKINSVILLE, GA.
Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: I. Nitrate-Nitrogen and Chloride Distribution in Soil Profiles,
W79-05641 5B

SOUTHERN PIEDMONT CONSERVATION RESEARCH CENTER, WATKINSVILLE, GA.
Nitrogen and Chloride Movement in Small Upland Piedmont Watersheds: II. Nitrogen and Chloride Transport in Runoff,
W79-05642 5B

SOUTHERN RESEARCH INST., BIRMINGHAM, AL.
Desalination by Electrosorption and Desorption,
W79-05575 3A

Investigation of Chelation as a Means of Removing Ions from Sea Water,
W79-05868 3A

Demineralization by Transport Depletion,
W79-05876 3A

SOUTHWEST RESEARCH INST., SAN ANTONIO, TX.
An Investigation of the Use of Acoustic Vibrations to Improve Heat Transfer Rates and Reduce Scaling in Distillation Units Used for Saline Water Conversion,
W79-05877 3A

SPORT FISHING INST., WASHINGTON, DC.
Evaluation of Planning for Fish and Wildlife, Lake Sharpe Reservoir Project,
W79-05717 6G

STATE UNIV. OF NEW YORK AT ALBANY.
The Minimum Requirements for Sea Water Conversion Processes,
W79-05576 3A

STATE UNIV. OF NEW YORK AT BUFFALO. DEPT. OF BIOLOGY.
Effect of Environmental Variables on Fish Impingement,
W79-05779 5C

STATE UNIV. OF NEW YORK AT STONY BROOK. MARINE SCIENCES RESEARCH CENTER.
Distribution of Hydrographic Properties in the New York Bight Apex,
W79-05683 1A

Raritan Bay as a Source of Ammonium and Chlorophyll A for the New York Bight Apex,
W79-05693 5B

STEARNS-ROGER, INC., DENVER, CO.
Annual Report (FY 1969) Freeport Test Facility and Vertical-Tube-Evaporator Test Bed Plant, Freeport, Texas,
W79-05652 3A

First Annual Report: Saline Water Conversion Plant No 1, Freeport, Texas.
W79-05662 3A

STEVENS INST. OF TECH., HOBOKEN, NJ. DEPT. OF MECHANICAL ENGINEERING.
Chemistry of Nitrification-Denitrification Process,
W79-05737 5D

STONE AND WEBSTER ENGINEERING CORP., BOSTON, MA.
Engineering Implications of New Fish Screening Concepts,
W79-05785 8I

STRUTHERS WELLS CORP., WARREN, PA.
A New Process for the Production of Fresh Water from Sea Water,
W79-05871 3A

SYRACUSE UNIV., NY.
Trace Metal Transport from Mining, Milling, and Smelting Watersheds,
W79-05858 5B

SYRACUSE UNIV., NY. DEPT. OF CHEMICAL ENGINEERING AND MATERIALS SCIENCE.
Freezing Process Studies,
W79-05653 3A

SYRACUSE UNIV. RESEARCH INST., NY.
The Properties of Gas Hydrates and Their Use in Demineralizing Sea Water,
W79-05656 3A

TEACHERS COLL., NEW YORK. DEPT. OF SCIENCE EDUCATION.
Developmental Tests on the Use of Fluorescent Tracers and Backwash Sediment-Load Samplers to Measure the Beach Drift Component of Littoral Transport at Sandy Hook, New Jersey,
W79-05688 2J

TECHNION - ISRAEL INST. OF TECH., HAIFA. DEPT. OF AGRICULTURAL ENGINEERING.
A Note on the Economic Significance of Uniform Water Application,
W79-05816 3F

TECHNISCHE UNIV., BRUNSWICK (GERMANY, F.R.).
Land and Water Use in Saudi Arabia,
W79-05561 5G

TEESSIDE POLYTECHNIC, MIDDLESBOROUGH (ENGLAND). DEPT. OF CIVIL AND STRUCTURAL ENGINEERING.
Evaluation of the Rate of Decrease in the Iron Content of Water Pumped from a Flooded Shaft Mine in County, Durham, England,
W79-05933 2K

TENNESSEE UNIV., KNOXVILLE. DEPT. OF ENGINEERING SCIENCE AND MECHANICS.
Mathematical Model and Computer Simulation of the Population Dynamics of Zooplankton in Lake and Estuary Ecosystems,
W79-05739 5C

TENNESSEE VALLEY AUTHORITY, NORRIS. DIV. OF FORESTRY, FISHERIES, AND WILDLIFE DEVELOPMENT.
A Method for Determining Growth and Mortality Rates of Ichthyoplankton,
W79-05765 5C

TETRA TECH, INC., LAFAYETTE, CA.
Survival of Planktonic Organisms Following Passage Through a Simulated Power Plant Condenser Tube,
W79-05763 5C

A Mathematical Model of the Interactions of an Aquatic Ecosystem and a Thermal Power Station Cooling System,
W79-05781 5C

TEXAS A AND M COLL., COLLEGE STATION. DEPT. OF OCEANOGRAPHY.
Development of the Solvent Demineralization of Saline Water,
W79-05650 3A

Research on Liquid-Liquid Extraction for Saline Water Conversion,
W79-05654 3A

TEXAS A AND M UNIVERSITY, COLLEGE STATION.
Effects of Water Management and Soil Physical Properties on Cotton Production in the Rolling Plains,
W79-05557 3F

TEXAS AGRICULTURAL EXPERIMENT STATION, WESLACO.
Cation Exchange Equilibria in a Mixed Soil System Containing Three Heterovalent Cations,
W79-05808 2G

TEXAS INSTRUMENTS INC., DALLAS. ECOLOGICAL SERVICES.
Twentieth-Century Semi-Arid Climates and Climatic Fluctuations in Texas and Northeastern Mexico,
W79-05563 2A

TEXAS TECH UNIV., LUBBOCK. DEPT. OF PARK ADMINISTRATION AND LANDSCAPE ARCHITECTURE.
Watershed Inventory Studies of Guadalupe Mountains National Park, Texas,
W79-05610 4D

TEXAS UNIV. HEALTH SCIENCE CENTER AT HOUSTON. SCHOOL OF PUBLIC HEALTH.
Nitrates and Bacterial Distribution in Rural Domestic Water Supplies,
W79-05524 5B

TOKYO UNIV. (JAPAN). INST. OF INDUSTRIAL SCIENCE.
Sorption and Accumulation of Cadmium in the Sediment of the Tama River,
W79-05525 5A

TORO CO., RIVERSIDE, CA.
The Use of Computers to Nozzle Center Pivot Systems,
W79-05995 3F

TRENT UNIV., PETERBOROUGH (ONTARIO).
Snow and Ice in the Phosphorus Budget of a Lake in South Central Ontario,
W79-05620 2C

TRINITY RIVER AUTHORITY, ARLINGTON, TX. PLANNING AND ENVIRONMENTAL MANAGEMENT DIV.
A Review of Phytoplankton Studies in Lake Livingston, Texas,
W79-05806 5C

UNION CARBIDE CORP., OAK RIDGE, TN. NUCLEAR DIV.
Groundwater Sampling in Uranium Reconnaissance,
W79-05521 5A

UNITED ENGINEERS AND CONSTRUCTORS, INC., PHILADELPHIA, PA.
Preliminary Studies on the Operating Aspects of Small Slot Width Wedgewire Screens with Conceptual Designs for Power Station Use,
W79-05787 8I

UNITED SCIENCE ASSOCIATES, INC., PASADENA, CA.
Research on Role of Ligand Molecules on Ionization Potentials,
W79-05864 3A

UNIVERSAL OIL PRODUCTS, INC., SAINT PAUL, MN. JOHNSON DIV.
Welding Still Widely Used in Drilling Industry,
W79-06000 8A

UNIVERSIDAD CENTRAL DE VENEZUELA, CARACAS.
Influence of Non-Point Pollution Sources in Connection with the Tuy River Basin Sanitation Studies,
W79-05740 5A

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES. DEPT. OF AEROSPACE ENGINEERING; AND UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES. DEPT. OF MECHANICAL ENGINEERING.
A Note on the Internal Solitary Waves Produced by Tidal Flow Over a Three-Dimensional Ridge,
W79-05631 2L

UTAH STATE UNIV., LOGAN. DEPT. OF SOILS AND BIOMETEOROLOGY.
Potential for Using Saline Waste Water from Electrical Power Plants for Irrigation,
W79-05829 3C

VERMONT UNIV., BURLINGTON. SCHOOL OF NATURAL RESOURCES.
Impacts of Recreation on Riparian Soils and Vegetation,
W79-05843 4C

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.
Evaluation of Ichthyoplankton Sampling Gear Used in Power Plant Entrainment Studies,
W79-05759 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF AGRONOMY.
Effect of Septic Tank Effluent on the Base Status of Two Tile-Drained Soils,
W79-05945 5B

VIRGINIA STATE WATER CONTROL BOARD, RICHMOND.
Water Quality Improvements from Upgraded Waste Treatment,
W79-05503 5D

WADE (R.M.) CO., PORTLAND, OR. (ASSIGNEE).
Drive Means for Irrigation System,
W79-05954 3F

WAFILIN B.V., SWOLLE (NETHERLANDS). (ASSIGNEE).
Removing Coagulable Substances from an Aqueous Medium,
W79-05956 5D

WASHINGTON UNIV., SEATTLE. DEPT. OF OCEANOGRAPHY.
Lower Cook Inlet Meroplankton,
W79-05913 5C

WASHINGTON UNIV., ST. LOUIS, MO. CENTER FOR THE BIOLOGY OF NATURAL SYSTEMS.
Determination of Optimal Well Capacities for Continuous Irrigation Programs,
W79-05825 3F

WATER RESOURCES RESEARCH CENTER, UNIVERSITY OF HAWAII, HONOLULU, HAWAII.
A Print-Plot Display System for a Linear Programming-Based Resources Planning Model,
W79-05797 6A

WEST PAKISTAN AGRICULTURAL UNIV., LYALLPUR. DEPT. OF SOIL SCIENCES.
Electron Probe Microanalytical Studies of Phosphorus Distribution Within Soil Fabric,
W79-05809 2G

Electron Probe Microanalysis of Calcite Grains Containing Phosphorus in Soil,
W79-05810 2G

WESTERN INDEPENDENT RESEARCH LAB., INC., LOS ANGELES, CA.
Demineralization of Saline Water Through Pressurization Cycles with Ion Exchange Materials,
W79-05580 3A

WESTERN WASHINGTON UNIV., BELLINGHAM.
Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas,
W79-05909 5C

Plant Communities of Alaskan Arctic Beaches,
W79-05910 5C

Preliminary Investigations of Trophic Relationships of the Arctic Shallow Water Marine Ecosystem,
W79-05911 5C

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA. (ASSIGNEE).
Process and Apparatus for Removal of Contaminants from Water,
W79-05957 5D

WHIRLPOOL CORP., ST. JOSEPH, MI. RESEARCH LABS.
Research on Thermoelectric Heat Pumps,
W79-05875 3A

WISCONSIN UNIV.-MADISON. LAB. OF LIMNOLOGY.
Assessment of a Cooling Lake Ecosystem,
W79-05964 2H

WISCONSIN UNIV., MADISON. WATER RESOURCES CENTER.
Frequency and Extent of Wind-Induced Resuspension of Bottom Material in the U.S. Great Lakes Nearshore Waters,
W79-05736 2J

WISCONSIN UNIV.-MILWAUKEE. CENTER FOR GREAT LAKES STUDIES.
Inertial Currents in Lake Ontario, Winter 1972-73 (IFYGL),
W79-05634 2H

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA.
Benthic-Pelagic Coupling in the New York Bight,
W79-05706 5C

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA.; JOHNS HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.; AND NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABS.
Physical Oceanography of the Middle Atlantic Bight,
W79-05680 2J

WORLD HEALTH ORGANIZATION, COPENHAGEN (DENMARK). REGIONAL OFFICE FOR EUROPE.
Health Hazards from Drinking-Water.
W79-05726 5A

YALE UNIV., NEW HAVEN, CT. DEPT. OF ENGINEERING AND APPLIED SCIENCE.
Research on Forced-Circulation and Dropwise Condensation Techniques for Improving Heat Transfer Rates for Vapor Compression Evaporators,
W79-05646 3A

ACCESSION NUMBER INDEX

/79-05501 3A
/79-05502 5D
/79-05503 5D
/79-05504 5D
/79-05505 5E
/79-05506 5E
/79-05507 5D
/79-05508 5C
/79-05509 5C
/79-05510 5C
/79-05511 5C
/79-05512 5C
/79-05513 5C
/79-05514 5C
/79-05515 5C
/79-05516 5C
/79-05517 5C
/79-05518 2C
/79-05519 5E
/79-05520 5A
/79-05521 5A
/79-05522 5A
/79-05523 2B
/79-05524 5B
/79-05525 5A
/79-05526 2A
/79-05527 2C
/79-05528 2C
/79-05529 2D
/79-05530 7B
/79-05531 2E
/79-05532 2L
/79-05533 2J
/79-05534 2L
/79-05535 2J
/79-05536 2E
/79-05537 8B
/79-05538 8B
/79-05539 8B
/79-05540 8B
/79-05541 2E
/79-05542 2J
/79-05543 8B
/79-05544 4A
/79-05545 2C
/79-05546 4C
/79-05547 4C
/79-05548 2A
/79-05549 5B
/79-05550 4A
/79-05551 2F
/79-05552 4B
/79-05553 2A
/79-05554 4B
/79-05555 6E
/79-05556 3B
/79-05557 3F
/79-05558 2J
/79-05559 2J
/79-05560 6E
/79-05561 5G
/79-05562 6B
/79-05563 2A
/79-05564 5C
/79-05565 6B
/79-05566 6C
/79-05567 2H
/79-05568 6B
/79-05569 2F
/79-05570 2A
/79-05571 2B
/79-05572 10C
/79-05573 3A
/79-05574 3A
/79-05575 3A
/79-05576 3A
/79-05577 3A
/79-05578 3A
/79-05579 3A
/79-05580 3A
/79-05581 3A
/79-05582 5B
/79-05583 6B
W79-05584 5C
W79-05585 7C
W79-05586 4A
W79-05587 5B
W79-05588 6A
W79-05589 5B
W79-05590 2A
W79-05591 2F
W79-05592 6D
W79-05593 2L
W79-05594 7C
W79-05595 2E
W79-05596 5B
W79-05597 7C
W79-05598 7C
W79-05599 7C
W79-05600 7C
W79-05601 7C
W79-05602 7C
W79-05603 7C
W79-05604 2F
W79-05605 5A
W79-05606 7C
W79-05607 4B
W79-05608 2F
W79-05609 7C
W79-05610 4D
W79-05611 2C
W79-05612 2H
W79-05613 2C
W79-05614 7C
W79-05615 2C
W79-05616 8A
W79-05617 7B
W79-05618 5C
W79-05619 2B
W79-05620 2C
W79-05621 5A
W79-05622 5B
W79-05623 2L
W79-05624 3C
W79-05625 2E
W79-05626 2K
W79-05627 5A
W79-05628 2B
W79-05629 2E
W79-05630 5C
W79-05631 2L
W79-05632 2C
W79-05633 7B
W79-05634 2H
W79-05635 2H
W79-05636 2H
W79-05637 2L
W79-05638 2L
W79-05639 2L
W79-05640 2L
W79-05641 5B
W79-05642 5B
W79-05643 5B
W79-05644 3A
W79-05645 3A
W79-05646 3A
W79-05647 3A
W79-05648 3A
W79-05649 3A
W79-05650 3A
W79-05651 3A
W79-05652 3A
W79-05653 3A
W79-05654 3A
W79-05655 3A
W79-05656 3A
W79-05657 3A
W79-05658 1A
W79-05659 3A
W79-05660 3A
W79-05661 3A
W79-05662 3A
W79-05663 3A
W79-05664 5C
W79-05665 5C
W79-05666 5C
W79-05667 5C
W79-05668 5C
W79-05669 5C
W79-05670 5C
W79-05671 5C
W79-05672 5C
W79-05673 5C
W79-05674 5C
W79-05675 5C
W79-05676 5C
W79-05677 5C
W79-05678 5C
W79-05679 5B
W79-05680 2J
W79-05681 5B
W79-05682 1A
W79-05683 1A
W79-05684 2J
W79-05685 5B
W79-05686 5C
W79-05687 5C
W79-05688 2J
W79-05689 5B
W79-05690 5B
W79-05691 5B
W79-05692 5B
W79-05693 5B
W79-05694 5B
W79-05695 5B
W79-05696 5B
W79-05697 5B
W79-05698 5C
W79-05699 5C
W79-05700 5C
W79-05701 5C
W79-05702 5C
W79-05703 5C
W79-05704 2L
W79-05705 5C
W79-05706 5C
W79-05707 5C
W79-05708 5C
W79-05709 5C
W79-05710 5C
W79-05711 5C
W79-05712 5C
W79-05713 5C
W79-05714 6A
W79-05715 6A
W79-05716 2E
W79-05717 6G
W79-05718 5C
W79-05719 2E
W79-05720 2E
W79-05721 4A
W79-05722 5G
W79-05723 6B
W79-05724 6E
W79-05725 5G
W79-05726 5A
W79-05727 3A
W79-05728 5C
W79-05729 5C
W79-05730 5C
W79-05731 5C
W79-05732 5C
W79-05733 5C
W79-05734 5C
W79-05735 5D
W79-05736 2J
W79-05737 5D
W79-05738 5C
W79-05739 5C
W79-05740 5A
W79-05741 5C
W79-05742 5C
W79-05743 5C
W79-05744 5C
W79-05745 5C
W79-05746 5C
W79-05747 5C
W79-05748 6C
W79-05749 6C
W79-05750 6B
W79-05751 6B
W79-05752 6E
W79-05753 6E
W79-05754 5C
W79-05755 5C
W79-05756 5C
W79-05757 5C
W79-05758 5C
W79-05759 5C
W79-05760 5C
W79-05761 5C
W79-05762 5C
W79-05763 5C
W79-05764 5C
W79-05765 5C
W79-05766 5C
W79-05767 5C
W79-05768 5C
W79-05769 5C
W79-05770 5C
W79-05771 5C
W79-05772 5C
W79-05773 5C
W79-05774 5C
W79-05775 5C
W79-05776 5C
W79-05777 5C
W79-05778 5C
W79-05779 5C
W79-05780 5C
W79-05781 5C
W79-05782 5C
W79-05783 5C
W79-05784 5C
W79-05785 8I
W79-05786 8I
W79-05787 8I
W79-05788 8I
W79-05789 6G
W79-05790 8I
W79-05791 4B
W79-05792 7C
W79-05793 7B
W79-05794 5B
W79-05795 2H
W79-05796 6B
W79-05797 6A
W79-05798 2D
W79-05799 2F
W79-05800 2H
W79-05801 2A
W79-05802 2J
W79-05803 3F
W79-05804 2J
W79-05805 3F
W79-05806 5C
W79-05807 5B
W79-05808 2G
W79-05809 2G
W79-05810 2G
W79-05811 5G
W79-05812 2K
W79-05813 2I
W79-05814 3C
W79-05815 3F
W79-05816 3F
W79-05817 2I
W79-05818 3F
W79-05819 5B
W79-05820 3F
W79-05821 5B
W79-05822 5B
W79-05823 5B
W79-05824 5B
W79-05825 3F
W79-05826 5B
W79-05827 2F
W79-05828 5D
W79-05829 3C
W79-05830 5C
W79-05831 5D
W79-05832 5B

W79-05833	2C
W79-05834	5B
W79-05835	5G
W79-05836	2B
W79-05837	2A
W79-05838	2H
W79-05839	5C
W79-05840	7B
W79-05841	5B
W79-05842	5A
W79-05843	4C
W79-05844	2E
W79-05845	6D
W79-05846	2J
W79-05847	7B
W79-05848	5A
W79-05849	5B
W79-05850	5B
W79-05851	2F
W79-05852	2F
W79-05853	2A
W79-05854	2D
W79-05855	2B
W79-05856	2B
W79-05857	2C
W79-05858	5B
W79-05859	7B
W79-05860	2C
W79-05861	2G
W79-05862	7B
W79-05863	2B
W79-05864	3A
W79-05865	5B
W79-05866	6G
W79-05867	5D
W79-05868	3A
W79-05869	3A
W79-05870	3A
W79-05871	3A
W79-05872	3A
W79-05873	3A
W79-05874	3A
W79-05875	3A
W79-05876	3A
W79-05877	3A
W79-05878	3A
W79-05879	3A
W79-05880	3A
W79-05881	3A
W79-05882	3A
W79-05883	2A
W79-05884	5C
W79-05885	5C
W79-05886	5C
W79-05887	5C
W79-05888	5C
W79-05889	5C
W79-05890	5C
W79-05891	5C
W79-05892	5C
W79-05893	5C
W79-05894	5C
W79-05895	5C
W79-05896	5C
W79-05897	5C
W79-05898	5C
W79-05899	5C
W79-05900	5C
W79-05901	5C
W79-05902	5C
W79-05903	5C
W79-05904	5C
W79-05905	5C
W79-05906	5C
W79-05907	5C
W79-05908	5C
W79-05909	5C
W79-05910	5C
W79-05911	5C
W79-05912	5C
W79-05913	5C
W79-05914	5C
W79-05915	5C
W79-05916	5C
W79-05917	5C
W79-05918	5C
W79-05919	5C
W79-05920	5C
W79-05921	5C
W79-05922	5C
W79-05923	5C
W79-05924	5C
W79-05925	5C
W79-05926	5C
W79-05927	5C
W79-05928	5C
W79-05929	5C
W79-05930	5C
W79-05931	5B
W79-05932	5B
W79-05933	2K
W79-05934	2I
W79-05935	5B
W79-05936	5A
W79-05937	5B
W79-05938	2E
W79-05939	5B
W79-05940	5B
W79-05941	2E
W79-05942	5B
W79-05943	5B
W79-05944	5B
W79-05945	5B
W79-05946	5B
W79-05947	5B
W79-05948	5D
W79-05949	8F
W79-05950	5D
W79-05951	8C
W79-05952	3F
W79-05953	3F
W79-05954	3F
W79-05955	5D
W79-05956	5D
W79-05957	5D
W79-05958	3A
W79-05959	3F
W79-05960	3F
W79-05961	5G
W79-05962	5D
W79-05963	5D
W79-05964	2H
W79-05965	2A
W79-05966	2E
W79-05967	7A
W79-05968	7C
W79-05969	6E
W79-05970	5B
W79-05971	7A
W79-05972	5B
W79-05973	7B
W79-05974	5B
W79-05975	6D
W79-05976	7B
W79-05977	7B
W79-05978	4C
W79-05979	4A
W79-05980	2E
W79-05981	4A
W79-05982	2F
W79-05983	7C
W79-05984	7C
W79-05985	6D
W79-05986	6A
W79-05987	6D
W79-05988	6D
W79-05989	7C
W79-05990	3F
W79-05991	3F
W79-05992	3F
W79-05993	3F
W79-05994	3F
W79-05995	3F
W79-05996	3F
W79-05997	3F
W79-05998	8H
W79-05999	8A
W79-06000	8A

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W79-05802--05805 05807--05826 05931--05932 05934--05937 05939--05940 05942--05944 05946--05947 05969 05979--05980 05990--05997	48
DOE Oak Ridge National Laboratory, Nuclear Radiation and Safety	W79-05509--05516 05754--05790	45
Illinois State Water Survey, Hydrology	W79-05518--05552 05611--05617 05619--05629 05631--05643 05827 05832--05863 05883, 05933 05938, 05941 05945	104
Institute of Paper Chem., Water Pollution from Pulp and Paper Industry	W79-05502--05507	6
National Water Well Association, Water Well Construction Technology	W79-05998--06000	3
University of Arizona, Arid Land Water Resources	W79-05553--05571 05610	20
University of N. Carolina, Metropolitan Water Resources Planning and Management	W79-05714--05717 05719--05725	11

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTA
A. CENTERS OF COMPETENCE (cont.)		
University of Wisconsin, Eutrophication	W79-05508, 05517 05618, 05630 05718 05728--05747 05806	2
University of Wisconsin, Water Resources Economics	W79-05748--05753	
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-05582--05584 05664 05791--05801 05828--05831 05964	2
C. OTHER		
Information Planning Associates, Inc.	W79-05572--05581 05644--05663 05864--05882	
Ocean Engineering Infor. Service (Patents)	W79-05948--05963	
Ocean Engineering Infor. Service (Outer Continental Shelf)	W79-05665--05713 05884--05930	1
Office of Water Research and Technology	W79-05501	
U. S. Geological Survey	W79-05585--05609 05965--05968 05970--05978 05981--05989	

☆U.S. GOVERNMENT PRINTING OFFICE: 1979-281-061/1

CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Illinois State Water Survey.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

Supported by the Environmental Protection Agency in cooperation with WRSIC

- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

0 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

U.S. MAIL

POSTAGE AND FEES PAID
U S DEPARTMENT OF COMMERCE
COM 211

AN EQUAL OPPORTUNITY EMPLOYER

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OFFICIAL BUSINESS

PRINTED MATTER

John Littlewood
Documents Division
220 D Library
Champaign, IL 6/82

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, U.S., and Mexico please use this price schedule; other addressees write for Folder PR-360-4.

A01	$3.00	E01	$3.25	T01	$110.00
A02	4.00	E02	4.75	T02	125.00
A03	4.50	E03	6.25	T03	175.00
A04	5.25	E04	7.50	T04	250.00
A05	6.00	E05	9.00	T05	300.00
A06	6.50	E06	10.50	T06	350.00
A07	7.25	E07	12.50	T07	400.00
A08	8.00	E08	15.00	T08	450.00
A09	9.00	E09	17.50	T09	500.00
A10	9.25	E10	20.00	T10	550.00
A11	9.50	E11	22.50	T11	600.00
A12	10.75	E12	25.00	T12	650.00
A13	11.00	E13	28.00	T13	675.00
A14	11.75	E14	31.00	T14	750.00
A15	12.00	E15	34.00	T15	800.00
A16	12.50	E16	37.00	T16	850.00
A17	13.00	E17	40.00	T17	900.00
A18	13.25	E18	45.00	T18	950.00
A19	14.00	E19	50.00	T19	1,000.00
A20	14.50	E20	60.00	T99	*
A21	15.00	E99	*		
A22	15.25				
A23	15.50	N01	28.00		
A24	16.25	N02	50.00		
A25	16.50				
A99	*				

*Contact NTIS for price quote

BOUND BY
HNM

UNIVERSITY OF ILLINOIS-URBANA
3 0112 084232872